26TH ICHST

VIRTUAL CONGRESS

JULY 25–31, 2021

PRAGUE

26th International Congress of History of Science and Technology

BOOK OF ABSTRACTS

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CONGRESS PROGRAMME

Sunday, July 25, 2021 17:00 – 17:50

Virtual Hall 1

Welcome Speeches, Opening

Chair: Petr Svobodny, Milada Sekyrkova, Mike Osborne, Juliane Mikoletzky

Michael Osborne (United States)
Tomas Zima (Czech Republic)
Juliane Mikoletzky (Austria)
Petr Svobodny (Czech Republic)

Sunday, July 25, 2021 18:00 – 20:00

Virtual Hall 1

Plenary Symposium Pandemics, science, and society - ID 318

Symposium organizer: Michael Osborne, Marcos Cueto

18:00 - 18:30 A001 ID: 852	What is an epidemic?	Warwick Anderson
18:30 - 19:00 A002 ID: 716	Bolsonaro's chloroquine: science, pandemic, and pandemonium in Brazil	Marcos Cueto
19:00 - 19:30 A003 ID: 388	Genetic engineering and prospects for living in a pandemic	Luis Campos
19:30 - 20:00 A004 ID: 665	Commentary	Mary Brazelton

Monday, July 26, 2021 10:00 – 12:00

Virtual Hall 1

Symposium Social factors in the passage from invention to technological system (ICOHTEC) - ID 161

Symposium organizer: Susan Schmidt-Horning, Jan Musekamp

Virtual Hall 1		
Chair: Jan Musekamp		
10:00 - 10:25 A005 ID: 531	Making an invention known. Importance of the socio-economic network in the innovation processes concerning architectural terracotta, France, 19th century	Cyril Lacheze
10:25 - 11:00 A006 ID: 532	Processes at work in the emergence and militarization of a technological system: seaplanes in France in the 1910s	Marion Weckerle
11:00 - 11:30 A007 ID: 936	Clean and save food for the urban consumer: the modernization of yoghurt production	Elitsa Stoilova

Monday, July 26, 2021 10:00 – 12:00

Virtual Hall 2		
Symposium The perils of prediction (DHST- DLMPST Joint Commission) - ID 349 Symposium organizer: Theodore Arabatzis, Ana Simões Chair: Theodore Arabatzis		
10:00 - 10:30 A008 ID: 776	Prediction in and about science	Hasok Chang
10:30 - 11:00 A009 ID: 627	Engineering, prediction, and mathematics	Johannes Lenhard
11:00 - 11:30 A010 ID: 757	The perils of predicting complex systems: And what we can do without prediction	Miles MacLeod
11:30 - 12:00 A011 ID: 593	The many faces of prediction. Lessons from the various astronomical expeditions organized in the 1910s to test Einstein's light bending prediction	Ana Simões

Monday, July 26, 2021 10:00 – 12:00

Virtual Hall 3
Symposium (Part 1/2) Giants and dwarfs in the transformations of mathematics in the XVIII century -

Virtual Hall 3		
ID 1006 Symposium organizer: Davide Crippa, Maria Rosa Massa Esteves Chair: Davide Crippa		
10:00 - 10:30 A012 ID: 480	Updating and innovation in Mathematics at the beginnings of the Spanish College of Artillery (1764-1808)	Juan Navarro-Loidi
10:30 - 11:00 A013 ID: 582	Pasqual Calbó, a Minorcan scientist-artist, and his mathematical course (c. 1800)	Antoni Roca-Rosell
11:00 - 11:30 A014 ID: 599	Reflections from mixed mathematics to physic mathematics in Spanish eighteenth century	Maria Rosa Massa Esteve

Monday, July 26, 2021 10:00 – 12:00

Virtual Hall 4		
Session I (Part 1/2) - History of Astronomy Chair: Carla Almeida		
10:00 - 10:20 A015 ID: 997	Diversifying modern astronomy: a history of academic activism	Jörg Matthias Determann
10:20 - 10:45 A016 ID: 1070	The Reconstruction of a Working Model of Heumgyeonggak-nu, Astronomical Clock	SANG HYUK KIM
10:45 - 11:05 A017 ID: 1175	Eclipse in the 19th century Ottoman applied source	Solmaz Ceren Özdemir
11:05 - 11:25 A018 ID: 1139	A Phylogenetic Appraisal of the Concept of Celestial SPHERE	Mohammad-Mahdi Sadrforati
11:25 - 11:45 A019 ID: 1061	A Survey of the First Persian Book in Modern Astronomy in Iran: Mas'ūd Anṣārī's A Summary of Astronomy (1819)	Mohammad-Hossein Poorabbas

Monday, July 26, 2021 10:00 – 12:00

Virtual Hall 5

Symposium Science and Religion from an angle - ID 166

Symposium organizer: Jaume Navarro, Kostas Tampakis

Chair: Jaume Navarro

10:00 - 10:30 A020 ID: 186	'Our English science': science and religion in an imperial context	Stuart Mathieson
10:30 - 11:00 A021 ID: 229	Catholics and national identity in modern Germany	Jeffrey Zalar
11:00 - 11:30 A022 ID: 1312	Darwin's Greek ancestors: Evolution, communism and nationalism in Greece (1880-1940)	Kostas Tampakis

Monday, July 26, 2021 10:00 – 12:00

Virtual Hall 6

Symposium (Part 1/3) Science and literature in small and large scales (Commission on Science and Literature)- ID 248

Symposium organizer: George N. Vlahakis, John Holmes

Chair: John Holmes

10:00 - 10:30 A023 ID: 722	'A Lord of the Rings-type world': J.R.R. Tolkien and the paleoanthropological imagination	John Holmes
10:30 - 11:00 A024 ID: 999	'To discerne the Lyon by his paw' – Imitation and plagiarism in early modern English science	Barbara Bienias
11:00 - 11:30 A025 ID: 1009	Illustrated scientific instruments books in late Qing: popular science, social fashion and trade	Hao Chang

Monday, July 26, 2021 10:00 – 12:00

Virtual Hall 7

Virtual Hall 7		
Session II (Part 1/3) - Biological Sciences - History of Zoology Chair: Petr Hampl		
10:00 - 10:30 A026 ID: 1204	A global history of zoos in the long nineteenth century	Oliver Hochadel
10:30 - 11:00 A027 ID: 1130	In multis una: Professionalization of wildlife zootechnics as a scientific practice in the zoological gardens' system of Mexico City	Hugo Domínguez Razo
11:00 - 11:30 A028 ID: 1163	May the peripheries lead us to the center: interwar Japanese zoology in Micronesia	Lisa Yoshikawa

Monday, July 26, 2021 10:00 – 12:00

Virtual Hall 8		
Symposium Re-imagining imaginaries. Rethinking our stories - ID 431 Symposium organizer: Gemma Cirac-Claveras, Flavio D'Abramo Chair: Gemma Cirac-Claveras		
10:00 - 10:30 A029 ID: 701	Aircrafts, ships and satellites. Space sciences as field sciences	Gemma Cirac-Claveras
10:30 - 11:00 A030 ID: 829	Human technologies and social policy: alternative sociotechnical imaginaries of mindfulness in the UK	Stephen Morris
11:00 - 11:30 A031 ID: 864	Health diplomats and scientific experts on the verge of contagious breakdowns	Flavio D'Abramo Gerardo Ienna
11:30 - 12:00 A032 ID: 872	The Frankenstein complex: historical imaginaries of cybernetics and cyborgs, and contemporary imaginaries of artificial intelligence and robots	Colin Williams

Monday, July 26, 2021 10:00 – 12:00

Virtual Hall 9

Virtual Hall 9		
Session III (Part 1/3) - Geography Chair: Marek Ďurčanský		
10:00 - 10:20 A033 ID: 1254	Giants and dwarfs among geographical societies in the "long" 19th century	Maximilian Georg
10:20 - 10:40 A034 ID: 1107	The Role of Academician F.N. Chernyshev (1856-1914) in the Research of the Arctic	Tatyana Filippova
10:40 - 11:00 A035 ID: 1002	Ez ikusi, ez ikasi ("do not see, do not learn"). The scientific adventure of a polymathic savant: Antoine D'abbadie	Carlos Hugo Sierra
11:00 - 11:20 A036 ID: 1073	"L'uomo e le scimie": Filippo De Filippi between evolution, expeditions, and science popularization	Carlo Bovolo
11:20 - 11:40 A037 ID: 1067	"Leaving some wiggle room" and "pursuing cooperation": the China-US scientific and technological exchanges on earthquake prediction during 1971-1979	Jingfei Zhang

Monday, July 26, 2021 10:00 – 12:00

Virtual Hall 10		
Symposium (Part 1/3) The Greek and medieval Ptolemy (CHAMA) - ID 91 Symposium organizer: Benno van Dalen, Nathan Sidoli Chair: Nathan Sidoli, David Juste, Benno van Dalen		
10:00 - 10:30 A038 ID: 331	Theodosius' /Spherics/ and Ptolemy's spherical astronomy	Nathan Sidoli
10:30 - 10:55 A039 ID: 156	Ptolemaeus Arabus et Latinus in 2021: achievements and outlook	David Juste
10:55 - 11:30 A040 ID: 111	The dissolution of the carrying sphere in Ptolemy's Planetary Hypotheses and its reception in the medieval Arabic tradition	Paul Hullmeine
11:30 - 12:00	Traces of the unrevised translation of the Almagest by Isḥāq ibn Ḥunayn	Pouyan

Virtual Hall 10		
A041 ID: 134		Rezvani

Monday, July 26, 2021 10:00 – 12:00

Virtual Hall 11		
Symposium (1/7) 16th Annual Symposium of the Social History of Military Technology (ICOHTEC) - ID 124 Symposium organizer: Barton C. Hacker, Ciro Paoletti		
10:00 - 10:30 A042 ID: 985	Collaborating hands: artisan, scholar, and the techniques of prototyping in 17th-century Korea	Hyeok Hweon Kang

Monday, July 26, 2021 10:00 – 20:00

Virtual Hall 16
Visit Virtual Lounges

Monday, July 26, 2021 13:00 – 15:00

Virtual Hall 1		
Session IV Engineering Chair: Jan Mikeš, Marcela Efmertová		
13:00 - 13:30 A043 ID: 1037	Capturing the dead: spirits, photography and the revival of the occult in Republican China (1912–1949)	Luis Fernando Bernardi Junqueira
13:30 - 14:00 A044 ID: 1100	"Last hired, first fired": systemic racism and the enduring dearth of diversity in the cockpit	Alan Meyer
14:00 - 14:30 A045 ID: 1278	Giant challenge – dwarf solution: re-invention of the wheel in the Russian hinterland	Svetlana Usenyuk-Kravchuk
14:30 - 15:00	Finding the right engineer: the process of selecting	Guillaume de Syon

Virtual Hall 1		
A046 ID: 1266	technicians to work in France, 1944-1950	

Monday, July 26, 2021 13:00 – 15:00

Virtual Hall 2		
Symposium Epidemic histories in southeast Asia (Pacific Circle) - ID 104 Symposium organizer: Warwick Anderson, Laurence Monnais Chair: Warwick Anderson		
13:00 - 13:30 A047 ID: 853	The sciences of disease prevention and the regulation of mobility in the Dutch East Indies (Indonesia)	Hans Pols
13:30 - 14:00 A048 ID: 816	Missions of mercy: trade routes and the dispersion of vaccination for smallpox in Southeast Asia	Claudia Michele Thompson
14:00 - 14:30 A049 ID: 765	Epidemic Invasions in the Democratic Republic of Vietnam	Michitake Aso

Monday, July 26, 2021 13:00 – 15:00

Virtual Hall 3		
Symposium (Part 2/2) Giants and dwarfs in the transformations of mathematics in the XVIII century - ID 357 Symposium organizer: Davide Crippa, Maria Rosa Massa Esteves Chair: Maria Rosa Massa Esteves		
13:00 - 13:30 A050 ID: 354	Mixed and applied mathematics in 18th century Prague	Davide Crippa
13:30 - 14:00 A051 ID: 689	A recently discovered text by Bolzano	Elías Fuentes Guillén
14:00 - 14:30 A052	Foundations in service of education: calculus textbooks in 18th century Prague	Jan Makovský

Virtual Hall 3		
ID: 927		
14:30 - 15:00 A053 ID: 433	Wendlingen: a Bohemian scientist in the Eighteenth Century Spanish Court	Joaquim Berenguer

Monday, July 26, 2021 13:00 – 15:00

Virtual Hall 4		
Session V Cold War Chair: Doubravka Olšáková		
13:00 - 13:30 A054 ID: 1024	Shaping Cold War science: The case of Herbert Simon and Hao Wang	Javier Poveda Figueroa
13:30 - 14:00 A055 ID: 884	One shall not kill the science. Kazimierz Petrusewicz and the attempts at the stalinist transformation of the Polish academic field	Łukasz Bertram

Monday, July 26, 2021 13:00 – 15:00

Virtual Hall 5		
Session VI (Part 1/3) - Academies, Societies, Laboratories and other Institutions Chair: Martin Franc		
13:00 - 13:30 A056 ID: 1208	Cooperative empires: Scientific societies in Vienna, imperial agents, and the "Orient" (1870–1914)	Johannes Mattes
13:30 - 14:00 A057 ID: 1098	Cooperation between Russia "Giants" and "Dwarfs" Scientific Centers in the Formation of a New Scientific and Educational Landscape in the First Years of Soviet Power	Elena Sinelnikova
14:00 - 14:30 A058 ID: 1186	To establish the Japanese society for history of science; two phases and historical backgrounds.	Daishi OKADA

Monday, July 26, 2021 13:00 – 15:00

Virtual Hall 6

Symposium Gas and electricity as an element of technological development in Latin Europe: technicians, processes, gas works, and networks (ICOHTEC) - ID 1314

Symposium organizer: Antonio Jesús Pinto Tortosa, Anna María Cardoso De Matos

Chair: Francesc X. Barca Salom

13:00 - 13:30 A059 ID: 1315	ENGINEERS AND TECHNICIANS IN LATIN EUROPEAN GAS INDUSTRY (1914-1945)	Antonio J Pinto
13:30 - 14:00 A060 ID: 1316	Gasworks in spain, the knowledge based in the technological diffusion	FRANCESC X. BARCA-SALOM
14:00 - 14:30 A061 ID: 1317	The adoption of the electricity in Barcelona at the nineteen century and the actuation of the gasworks	Joan Carles Alayo Manubens

Monday, July 26, 2021 13:00 – 15:00

Virtual Hall 7

Session VII (Part 1/2) - Biographies

Chair: Helena Durnová

13:00 - 13:30 A062 ID: 1116	"Narro, ergo sum" – Comparing autobiographical narratives in the history of Austrian science	Sandra Klos
13:30 - 14:00 A063 ID: 1249	Von Mises, Reichenbach, and Popper on the law of large numbers	Hans Fischer
14:00 - 14:30 A064 ID: 1252	Boscovich and Leibniz. A reappraisal	Luca Guzzardi
14:30 - 15:00 A065 ID: 1330	Some Research Directions Represented by N.D.Moiseev in his Monograph Essays on the Development of Stability Theory	V.N. Chinenova

Monday, July 26, 2021 13:00 – 15:00

Virtual Hall 8

Symposium (Part 1/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 204

Symposium organizer: Janet Laidla

Chair: Alison Boyle, Alison Boyle

13:00 - 13:30 A066 ID: 293	Transformations: Turning research experiments into teaching demonstrations	Peter Heering
13:30 - 14:00 A067 ID: 463	Tracing the life of 19th century laboratories in Greek educational institutions through historical textbooks and archival documents	Flora Paparou
14:00 - 14:30 A068 ID: 394	The impact of salih zeki's optical works on physics education in 20th-century ottoman turkey	Sena Aydın
14:30 - 15:00 A069 ID: 263	Robert Pohl in Madras: German teaching instruments and practices in India	Roland Wittje

Monday, July 26, 2021 13:00 – 15:00

Virtual Hall 9

Session III (Part 2/3) - Geography

Chair: Marek Ďurčanský

13:00 - 13:30 A070 ID: 1068	History of drought in Brazil: notes about the co-production of infrastructures, national policies and local realities	Jean Carlos Hochsprung Miguel
13:30 - 14:00 A071 ID: 1086	Beyond Scientific Ingenuity: The discovery of the "Dansgaard-Oeschger Events" and its socio-political context	Dania Achermann
14:00 - 14:30 A072 ID: 1145	Development of geomorphology in the USSR at the initial stage: scientific contribution of Innokentiy P. Gerasimov and Konstantin K. Markov	Alexey Sobisevich
14:30 - 15:00 A073 ID: 1129	GIS-Mapping and Building Territorial Planning In Colombia	Rodolfo Hernandez Perez

Monday, July 26, 2021 13:00 – 15:00

Virtual Hall 10

Symposium (Part 2/3) The Greek and medieval Ptolemy (CHAMA) - ID 92

Symposium organizer: Benno van Dalen, Nathan Sidoli

Chair: Benno van Dalen, David Juste

13:00 - 13:30 A074 ID: 113	Tracing Arabic translations of the Almagest in al-Farghani's Elements of Astronomy	Razieh-Sadat Mousavi
13:30 - 14:00 A075 ID: 342	An Almost Forgotten Contribution to the Tetrabiblos	Nadine Löhr
14:00 - 14:30 A076 ID: 112	(Dis)continuity of Ptolemaic planetary distances and sizes in Arabic astronomy	Hamid Bohloul
14:30 - 15:00 A077 ID: 174	A philological chimera: Pseudo-Ptolemy's Book of the Fruit and its transmission	Emanuele Rovati

Monday, July 26, 2021 13:00 – 15:00

Virtual Hall 11

Symposium (2/7) 16th Annual Symposium of the Social History of Military Technology (ICOHTEC) - ID 125

Symposium organizer: Barton C. Hacker, Ciro Paoletti

13:00 - 13:30 A078 ID: 212	The trace italienne, a military innovation with dramatic consequences on the besieged. The siege warfare during the Italian Wars (1494-1559)	Jacopo Pessina
13:30 - 14:00 A079 ID: 438	Italian imitations of French ordnance: an artillery revolution, or a logistical problem?	Fabrizio Ansani

Monday, July 26, 2021 13:00 – 15:00

Virtual Hall 12

Symposium Socialist Hydro-Expertise in Cold War Ghana : Cold War Technopolitics Beyond the Giants?

Virtual Hall 12		
(ICOHTEC) - ID 552 Symposium organizer: Jiří Janáč, Susan Schmidt-Horning Chair: Magdalena Zdrodowska		
13:00 - 13:30 A080 ID: 913	Export of Czechoslovak Hydro-expertise in the Cold War Era	Jiří Janáč
13:30 - 14:00 A081 ID: 637	Long Shadow of Colonialism. Path Dependence and Hydropower Projects in Ghana	Viktor Pál
14:00 - 14:30 A082 ID: 666	Damming the Cold War – Czechoslovak technopolicy in Ghana	Jakub Mazanec
14:30 - 15:00 A083 ID: 1089	Technocratic internationalism. GDR coal refinement and international cooperation during the early Cold War	Jan Zofka

Monday, July 26, 2021 15:30 – 17:30

Virtual Hall 1		
Symposium (Part 1/3) CHCMS (History of Chemistry and Molecular Sciences) - ID 912 Symposium organizer: Brigitte Van Tiggelen, Yoshiyuki Kikuchi Chair: Xavier Roqué		
15:30 - 16:00 A084 ID: 1298	Contributions of Central European chemists to the development of Brazilian chemistry in the 20th century	Letícia Pereira
16:00 - 16:30 A085 ID: 1299	Restructuring for Profit and Progress: Organizational Change in Centre des Recherches d'Aubervilliers (1953-2020)	Marcin Krasnodębski
16:30 - 17:00 A086 ID: 1300	'Nucleoproteins' 1959 Solvay Conference on Chemistry: a scientific network and (bio) chemistry state's case study in the late '50s	Yoanna Alexiou
17:00 - 17:30 A087 ID: 1301	Local Tourism, Cultural Heritage and Chemical Sites in Japan's Chubu Region: The Role of Private Companies	Yoshiyuki Kikuchi

Monday, July 26, 2021 15:30 – 17:30

Virtual Hall 2

Symposium Expanding the range of statistical mechanics: from Poincaré and von Zeipel to Smoluchowski and Fowler - ID 21

Symposium organizer: Scott A. Walter, Tilman Sauer

Chair: Tilman Sauer

15:30 - 16:00 A088 ID: 47	Stars as molecules: Poincaré and von Zeipel on globular clusters and the structure of the universe	Scott A. Walter
16:00 - 16:30 A089 ID: 328	From Statistical Mechanics to Random Fluctuations: Marian Smoluchowski's Research Program, 1904-1917	Chen-Pang Yeang
16:30 - 17:00 A090 ID: 189	The work on statistical mechanics by Ralph Fowler and his Cambridge group in the 1920s	Martin Niss

Monday, July 26, 2021 15:30 – 17:30

Virtual Hall 3

Symposium (Part 1/2) Science and empire in the age of global history (Science and Empire Commission) - ID 538

Symposium organizer: Thomás A. S. Haddad, Jahnavi Phalkey

Chair: Jahnavi Phalkey

15:30 - 16:00 A091 ID: 828	What can we learn from decolonial perspectives on colonial / decolonial sciences ?	Patrick Petitjean
16:00 - 16:30 A092 ID: 721	Symposium 538: Science and empire in the age of global history.	Deepak Kumar
16:30 - 17:00 A093 ID: 948	Migration, plantation, empires	Cristiana Bastos
17:00 - 17:30 A094 ID: 915	Of Mice and Snakes : a connected history of medicine in Brazil and India (1870-1914)	Matheus Alves Duarte da Silva

Monday, July 26, 2021 15:30 – 17:30

Virtual Hall 4

Symposium (Part 1/5) Re-scaling & de-centering the history of oceanography: the 'hidden figures' and hidden dimensions of global ocean science (ICHO) - ID 448

Symposium organizer: Penelope Hardy, Cornelia Lüdecke

Chair: Penelope Hardy

15:30 - 16:00 A095 ID: 871	An 'Indian' ocean? Marine biology and scientific authority in British India	Aviroop Sengupta
16:00 - 16:30 A096 ID: 844	Post-War Reconnaissance of Japanese Fishery and Ocean Science and its Contribution to the Development of U.S. Scientific Programs in the Pacific: 1947-1958	Carmel Finley
16:30 - 17:00 A097 ID: 784	Female Peruvian scientists in fishery science: The marine biologists of IMARPE, 1964-1982	Alejandra Osorio
17:00 - 17:30 A098 ID: 843	Recovering hidden histories of marine and aquatic invasion biology	Christine Keiner

Monday, July 26, 2021 15:30 – 17:30

Virtual Hall 5

Session VI (Part 2/3) - Academies, Societies, Laboratories and other Institutions

Chair: Martin Franc

15:30 - 16:00 A099 ID: 1136	Nearly fallen giant: the case of the Russian Academy of Sciences, experiencing the impact of the new management reform	Anna Fedorova
16:00 - 16:30 A100 ID: 1196	Emergence of Scientific Community in India: Role of Indian Science Congress Association, 1914-1947	Sneha Sinha

Monday, July 26, 2021 15:30 – 17:30

Virtual Hall 6

Symposium (Part 1/4) The materiality of knowledge circulation between China and Europe: physical

Virtual Hall 6

formats, epistemic genres, spatial localities (16th-18th century) (ISHEASTM) - ID 31

Symposium organizer: Huiyi Wu, Marta Hanson

Chair: Huiyi Wu

15:30 - 16:00 A101 ID: 655	Towards a Cross-Cultural History of Eurasian Medicine: The State of the Field	Marta Hanson
16:00 - 16:30 A102 ID: 281	Xu Shizhi and pulse diagnosis in eighteenth-century Naples	Henrietta Harrison
16:30 - 17:00 A103 ID: 53	Tactility, pulse, and body knowledge in transit: John Floyer's reading of diagnostic touch in English and Chinese medicine	Yijie Huang
17:00 - 17:30 A104 ID: 79	Crustaceans, crosses, and cures	Oana Baboi

Monday, July 26, 2021 15:30 – 17:30

Virtual Hall 7

Symposium Histories of materials: biographies, institutions, tools, across scale - ID 384

Symposium organizer: Arne Hessenbruch, Bernadette Bensaude-Vincent

15:30 - 16:00 A105 ID: 971	Biography of materials	Bernadette BENSAUDE-VINCENT
16:30 - 17:00 A106 ID: 979	Across scales in materials research	Ellan Spero
17:00 - 17:30 A107 ID: 921	Tools in the History of Materials Research	Joseph Martin

Monday, July 26, 2021 15:30 – 17:30

Virtual Hall 8

Virtual Hall 8		
Symposium (Part 2/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 205 Symposium organizer: Janet Laidla Chair: Roland Wittje, Roland Wittje		
15:30 - 16:00 A108 ID: 284	Crossing the boundaries between instrument makers, science, and industry	Christian Forstner
16:00 - 16:30 A109 ID: 478	From Paris to Prague: Precision Tuning across Boundaries	Pavel Šturm
16:30 - 17:00 A110 ID: 1078	Denis Papin's Digester: a European history	Marco Storni
17:00 - 17:30 A111 ID: 272	From steam engines to equatorial telescope mounts: Controlling power and crossing boundaries from 1780 to 1860	Richard Kremer

Monday, July 26, 2021 15:30 – 17:30

Virtual Hall 9		
Symposium Sources and resources in history of science: does size matter? (CBD) - ID 329 Symposium organizer: Stephen P. Weldo, Gavan McCarthy		
15:30 - 16:00 A112 ID: 925	Revealing the invisible: human versus computational approaches to bibliographic discovery	Stephen Weldon
16:00 - 16:30 A113 ID: 401	Object and objectivity: archives as interpretation	Venkat Srinivasan
16:30 - 17:00 A114 ID: 403	A fragment of the dissemination of the history of science in the Baltic States - the conference Scientiarum Baltica	Giedre Mikniene
17:00 - 17:30 A115 ID: 428	Big data management and visualization: how can dwarves find a place among giants?	Jose luiz goldfarb

Monday, July 26, 2021 15:30 – 17:30

Virtual Hall 10

Symposium (Part 3/3) The Greek and medieval Ptolemy (CHAMA) - ID 90

Symposium organizer: Benno van Dalen, Nathan Sidoli

Chair: Alexander Jones

15:30 - 16:00 A116 ID: 168	Greek texts by and related to Ptolemy recovered from the late antique palimpsest Ambrosiana L 99 sup.	Victor Gysembergh Alexander Jones Emanuel Zingg
16:00 - 16:30 A117 ID: 376	The Ptolemaic Analysis of the Hipparchian Lunar Model	Gonzalo Recio
16:30 - 17:00 A118 ID: 782	The gravitational influence of Jupiter on the Ptolemaic value for the eccentricity of Saturn	Christián C, Carman
17:00 - 17:30 A119 ID: 110	Ptolemy's tradition of astronomical tables in the Islamic world	Benno van Dalen

Monday, July 26, 2021 15:30 – 17:30

Virtual Hall 11

Symposium (Part 1/6) Transportation History: Solving problems or creating bottlenecks? Railway history in political and economic context (ICOHTEC) - ID 10

Symposium organizer: Timo Myllyntaus, Hugo Pereira

Chair: Timo Myllyntaus

15:30 - 16:00 A120 ID: 576	Engineers vs political and financial stakeholders in Portuguese railways: a sociotechnical approach to a peripheral nation (1850s-1910s)	Hugo Pereira
16:00 - 16:30 A121 ID: 623	Building Critical Infrastructure in the Past: The Railway Line St. Petersburg – Riihimäki in the 1860s	Timo Myllyntaus

Monday, July 26, 2021 15:30 – 17:30

Virtual Hall 12

Virtual Hall 12

Symposium VII (Part 1/2) Collaborations and Rivalries in the History of Mathematics (ICHM) (with IMU) - ID 84

Symposium organizer: Reinhard Siegmund-Schultze, June Barrow Green

Chair: Reinhard Siegmund-Schultze

15:30 - 16:00 A122 ID: 164	"If I have seen further": the fortunes of Newton and Hooke in the accepted narratives of the Scientific Revolution	Niccolò Guicciardini
16:00 - 16:30 A123 ID: 119	The Sailor and The Savant: The ebb and flow of a scientific partnership	Nicolas Michel
16:30 - 17:00 A124 ID: 135	Felix Klein (1849-1925) and Georg Pick (1859-1942): support and a (largely unknown) attempt to co-operate	Renate Tobies
17:00 - 17:30 A125 ID: 107	Ronald Ross and his 'capable assistant' Hilda Hudson: a collaboration on the mathematical theory of epidemics	June Barrow-Green

Monday, July 26, 2021 18:00 – 20:00

Virtual Hall 1

Symposium Size matters: exploring the textual dimensions of scientific knowledge in four centuries of British publishing (DHST- DLMPST Joint Commission) - ID 491

Symposium organizer: Agnes Bolinksa, Alex Aylward

Chair: Agnes Bolinksa

18:00 - 18:30 A126 ID: 606	'It is light, it is cheap, it is readable': volume, frequency and brevity in nineteenth-century medical journalism	Sally Frampton
18:30 - 19:00 A127 ID: 596	Big book, little book: sizing up mid-twentieth-century British biological books	Alex Aylward

Monday, July 26, 2021 18:00 – 20:00

Virtual Hall 2

Virtual Hall 2		
Symposium Museum revolutions? Transformations of science and technology display in Central and Eastern Europe since the 20th century - ID 386 Symposium organizer: Arne Schirrmacher, Jan Surman		
18:00 - 18:15 A128 ID: 460	E-POSTER Darwin in Moscow. Soviet Science Museums and the "Enlightenment of the Masses"	Mirjam Voerkelius
18:15 - 18:30 A129 ID: 501	E-POSTER Regional Industry, Interactive Exhibits, and Marxist History? Polytechnical Museums in East Germany	Martin Weiss
18:30 - 18:45 A130 ID: 443	E-POSTER Late and limited. The rebuilding of Berlin's science and technology museums in both parts of the divided city	Arne Schirrmacher
18:45 - 19:00 A131 ID: 629	E-POSTER From Museums to Centers: Exhibiting Science in Poland	Ewa Wyka

Monday, July 26, 2021 18:00 – 20:00

Virtual Hall 3		
Symposium (Part 2/2) Science and empire in the age of global history (Science and Empire Commission)- ID 539 Symposium organizer: Thomás A. S. Haddad, John Mathew Chair: Thomás A. S. Haddad		
18:00 - 18:30 A132 ID: 819	Scientific Research in Colonial India - Part 1: The Bombay Presidency	Pushkar Sohoni
18:30 - 19:00 A133 ID: 821	Scientific Research in Colonial India - Part II: The Princely States of Baroda and Travancore	John Mathew
19:00 - 19:30 A134 ID: 756	Did Kāśīnātha tarkālaṅkāra know sanskrit? recovering the thought worlds and practices of "brokers" in east india company india	Minakshi Menon

Monday, July 26, 2021 18:00 – 20:00

Virtual Hall 4		
Symposium Wet ecologies: The media in (under)water worlds - ID 447 Symposium organizer: Helen M. Rozwadowski, Vera Schwach Chair: Helen M. Rozwadowski		
18:00 - 18:30 A135 ID: 632	Imagining submarine and subterranean coral: Geology and the economics of marine fossil remains, Penny Magazine 1833	Anne Ricculli
18:30 - 19:00 A136 ID: 850	Luminous marine animals and an enlightened public: How bioluminescence popularized marine biology	Katharina Steiner
19:00 - 19:30 A137 ID: 795	Live from the depths: Telepresence and the production of deep ocean science	Alicia Caporaso
19:30 - 20:00 A138 ID: 668	Pteropods realized: From bio-indication to bio-inspiration	Samm Newton

Monday, July 26, 2021 18:00 – 20:00

Virtual Hall 5		
Symposium Colonial Science in the Pacific (Pacific Circle) - ID 634 Symposium organizer: Peter H. Hoffenberg, Roy MacLeod Chair: Hans Pols		
18:00 - 18:30 A139 ID: 972	Actor and Network in Science and Colonialism in the Western Pacific	Joseph Foukona
18:30 - 19:00 A140 ID: 953	Making Australian public scientists: measuring Victorian Scientific 'Giants' at 19th-Century Exhibitions	Peter Hoffenberg
19:00 - 19:30 A141 ID: 854	Comment	Hans Pols

Monday, July 26, 2021 18:00 – 20:00

Virtual Hall 6

E-posters (Part 1/3)

Chair: Milada Sekyrkova

18:00 - 18:10 A142 ID: 1060	E-POSTER Molecular terminology: the role of Euclid's Elements	Henk Kubbinga
18:10 - 18:20 A143 ID: 1097	E-POSTER History of meteorological glossaries and dictionaries: collective effort and contribution of individuals	Miloslav Müller
18:20 - 18:30 A144 ID: 1101	E-POSTER Galileo Ferraris and the Scuola di Elettrotecnica of the Regio Museo Industriale in Torino	Emma Angelini
18:30 - 18:40 A145 ID: 1115	E-POSTER The unacknowledged accounts of the studies of the moon in the 1620s in the correspondence of Hevelius and von Löwen	Jarosław Włodarczyk
18:40 - 18:50 A146 ID: 1000	E-POSTER On the criteria of assessment of scientific achievements: the case of Vernadsky	Tatiana Denisova

Monday, July 26, 2021 18:00 – 20:00

Virtual Hall 7

Session VII (Part 2/2) - Biographies

Chair: Helena Durnová

18:00 - 18:30 A147 ID: 1035	Khaim Garber (1903-1937), on Technology: Another Eliminated Stream of Marxian Philosophy on Technology.	Hiroshi Ichikawa
18:30 - 19:00 A148 ID: 1164	P C Ray and his role in Indian identity formation	ADITYA SUNDWA
19:00 - 19:30 A149 ID: 1179	Dr George Shuttleworth's 'scholarly self' and the creation of the mentally deficient child in nineteenth and early twentieth century Britain	Samir Hamdoud
19:30 - 20:00	"If Bogdanov takes on a task he gets it done even though it	Galina Krivosheina

Virtual Hall 7		
A150 ID: 1199	seems impossible to everyone…"	

Monday, July 26, 2021 18:00 – 20:00

Virtual Hall 8		
Symposium (Part 3/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 206 Symposium organizer: Janet Laidla Chair: Tayce Phillipson, Tayce Phillipson		
18:00 - 18:30 A151 ID: 255	Giants and dwarfs at the Ordnance Office in the Tower of London	Rebekah Higgitt
18:30 - 19:00 A152 ID: 320	Looking through and at giants: the iconography of telescopes and gigantism in the nineteenth century	Pedro Raposo
19:00 - 19:30 A153 ID: 1320	Fermenting at scale: ICI's 'Pruteen' experiment – from animal feed to bioplastic, 1967-1991	Rupert Cole
19:30 - 20:00 A154 ID: 1030	Small components, "Big Science": electronics and engineering at the Mullard Space Science Laboratory	Osnat Katz

Monday, July 26, 2021 18:00 – 20:00

Virtual Hall 9		
Session I (Part 2/2) - History of Astronomy Chair: Jörg Matthias Determann		
18:00 - 18:20 A155 ID: 1026	The sphere of anthony ascham: the earliest known english translation of sacrobosco's sphaera by a minor renaissance author among elite commentators	James Brannon
18:20 - 18:40 A156 ID: 1128	Astronomical tables in ancient Egyptian royal tombs from c. 1100 BCE	Sarah Symons
18:40 - 19:00	Is Oppenheimer the father of black holes?	Carla R. Almeida

Virtual Hall 9		
A157 ID: 1109		
19:00 - 19:20 A158 ID: 1160	Exploring Pluto and Europa: the U.S. planetary sciences and politics, 1989-2020	Michael J. Neufeld
19:20 - 19:40 A159 ID: 1142	A Hitheto Unknown Iranian Calendar Named Yamīnī	Maedeh Hosseinzadeh

Monday, July 26, 2021 18:00 – 20:00

Virtual Hall 10		
Symposium (Part 1/2) Politics, Protest and Big Technology (ICOHTEC) - ID 564 Symposium organizer: Susan Schmidt-Horning, Roberto Cantoni Chair: Peter Müürsepp		
18:00 - 18:30 A160 ID: 706	Transnational Localism? Knowledge Production in the Italian 1970s-80s Anti-Nuclear Movement	Roberto Cantoni
18:30 - 19:00 A161 ID: 891	Postcolonial nuclear consensus and contemporary anxieties: a history since the global re-enchantment with nuclear India	Kumar Sundaram Pathak
19:00 - 19:30 A162 ID: 649	The public lantern's interplay of light and darkness: between police monitoring, savings-based extinguishings, and protests (Paris, Barcelona, 18th c.)	Benjamin Bothereau

Monday, July 26, 2021 18:00 – 20:00

Virtual Hall 11		
Symposium (Part 2/6) Transportation History: Colonial and extra-European railways (ICOHTEC) - ID 489 Symposium organizer: Timo Myllyntaus, Hugo Pereira Chair: Hugo Pereira		
18:00 - 18:30 A163	Transport and public works in the Moroccan protectorate. The Tangiers-Fez railway (1914-1927) and civil engineer J.	Inmaculada Aguilar

Virtual Hall 11		
ID: 966	Eugenio Ribera	
18:30 - 19:00 A164 ID: 832	How the Panama Isthmus Railroad Accelerated American Commercial Expansionism	Shunsuke Munakata

Monday, July 26, 2021 18:00 – 20:00

Virtual Hall 12		
Symposium (Part 2/2) Collaborations and Rivalries in the History of Mathematics (ICHM) (with IMU) - ID 87 Symposium organizer: Reinhard Siegmund-Schultze, June Barrow Green Chair: June Barrow Green		
18:00 - 18:30 A165 ID: 109	Circumventing gendered barriers to knowledge through spousal cooperation: Mrs and Mr Mary Somerville	Brigitte Stenhouse
18:30 - 19:00 A166 ID: 221	George Boole & Mary Everest Boole	David Dunning
19:00 - 19:30 A167 ID: 118	Who counted Professor Weldon's crabs: Florence Weldon and the hidden labour of 19th century data analysis	Ursula Martin
19:30 - 20:00 A168 ID: 249	Richard von Mises and Hilda Geiringer: a partnership in applied mathematics emerging from a teacher-student relationship and welded by persecution	Reinhard Siegmund-Schultze

Monday, July 26, 2021 20:00 – 21:00

Virtual Hall 1
Commission on Women and Gender Studies Business Meeting

Monday, July 26, 2021 20:00 – 21:00

Virtual Hall 2

Virtual Hall 2

Commission for the History of Physics Meeting

Monday, July 26, 2021 20:00 – 21:00

Virtual Hall 3

Science & Empire Commission Meeting

Monday, July 26, 2021 20:00 – 21:00

Virtual Hall 12

ICHM Meeting

Tuesday, July 27, 2021 10:00 – 11:30

Virtual Hall 10

Symposium Crossing the borders between meteorology, climatology and geography (Commission on the History of Metereology and Commission on the History of Geography) - ID 424

Symposium organizer: Marcella Schmidt di Friedberg, Samuel Randalls
Chair: Marcella Schmidt di Friedberg

10:00 - 10:30 A169 ID: 583	The Maldivian Nakaiy calendar in the age of climate change	Marcella Schmidt di Friedberg
10:30 - 11:00 A170 ID: 581	For an epistemology of climate science(s) in Latin American: between convergences, breaks and perspectives	Antonio Carlos Oscar Júnior

Tuesday, July 27, 2021 10:00 – 12:00

Virtual Hall 1

Symposium (Part 1/3) Knowledge of the heavens in transcultural perspectives : the circulation of astronomy and astrology between civilizations - ID 142

Symposium organizer: Weixing Niu, Christopher Cullen

Virtual Hall 1		
Chair: Weixing Niu		
10:00 - 10:30 A171 ID: 178	The modes of adaptation of babylonian astronomical knowledge in early imperial China	Yuzhen Guan
10:30 - 11:00 A172 ID: 301	Rāhucāra of the Gārgīyajyotiṣa – The oldest Indian eclipse theory extant and its transmission in Central and East Asia	Bill Mak
11:00 - 11:30 A173 ID: 169	The planetary positions and zodiacal signs of Horoscope Astrology during the Tang and Song Dynasties	Zhijia Jin
11:30 - 12:00 A174 ID: 203	The competition between the 12 Zodiacal Signs and the 28 Lodges in Genethliacal Astrology China, 6th to 16th centuries CE	Shenmi Song

Tuesday, July 27, 2021 10:00 – 12:00

Virtual Hall 2		
Symposium Decolonising Pandemics? (Pacific Circle) - ID 512 Symposium organizer: Christine Winter Chair: Christine Winter		
10:00 - 10:30 A175 ID: 615	'Modernity as pandemic: settler Australia as an experiment in self-quarantine'	Lorenzo Veracini
10:30 - 11:00 A176 ID: 894	small pox, science and settler colonialism: contested historiographies	Geoffrey Gray
11:00 - 11:30 A177 ID: 970	epidemic and De-imperialisation through the case of Japanese Imperial Army Soldiers in PNG during WWII	Yasuko Hassall Kobayashi
11:30 - 12:00 A178 ID: 1292	Malaria, mobility, and the death of the fair races: German scientific models of hardiness as (inevitable) decolonization.	Christine Winter

Tuesday, July 27, 2021 10:00 – 12:00

Virtual Hall 3

Symposium Designing curricula as an interdisciplinary programmed framework in the history of science & scientific–technical teaching (IDTC) - ID 60

Symposium organizer: Gianna KATSIAMPOURA, Gustavo RODRIGUES ROCHA

Chair: Raffaele Pisano

10:00 - 10:30 A179 ID: 170	Can environmental philosophy enhance the understanding of the physical world?	Constantine (Kostas) Skordoulis
10:30 - 11:00 A180 ID: 243	A NoS Experimental Curriculum on motion: Galileo and His Contemporaries	Vincenzo Cioci
11:00 - 11:30 A181 ID: 208	Emergence and Contingency in Modern Scientific Theories. New Insights in Teaching.	Anastasios Kapodistrias

Tuesday, July 27, 2021 10:00 – 12:00

Virtual Hall 4

Symposium (Part 1/2) To explore from West to East: persons, methods and results - ID 81

Symposium organizer: Tatiana Feklova, Yuko Takigawa, Tatiana Feklova

10:00 - 10:30 A182 ID: 101	From Saint-Petersburg to Beijing. The line of magneto-meteorological investigations. Second half of 19 – early 20 centuries.	Tatiana Feklova
10:30 - 11:00 A183 ID: 335	History of technology	SUO BAO
11:00 - 11:20 A184 ID: 133	E-POSTER N.A. Nordenskiöld's polar expeditions and the Russian society	Andrey Skrydlov
11:20 - 11:35 A185 ID: 198	E-POSTER Imperial exploring expeditions: a case study on the archeographic expedition	Jen-Heng Chen

Tuesday, July 27, 2021 10:00 – 12:00

Virtual Hall 5

Symposium (Part 1/3) Reflections of science and technology in the Ottoman Empire: scientific interactions among various ethnic and religious backgrounds, societies and institutions - ID 436

Symposium organizer: Tuncay Zorlu, Efthymios Nicolaidis

Chair: Mustafa KAÇAR

10:00 - 10:20 A186 ID: 803	Issues and Problems of Addressing Multi-dimensional Scientific Activities in the Ottoman Empire	Ekmeleddin Ihsanoglu
10:20 - 10:35 A187 ID: 607	E-POSTER The Principle and Drawing of a Universal Asterlobe	Atilla Bir
10:35 - 10:50 A188 ID: 574	E-POSTER "Reflections of science and technology in the Ottoman Empire: scientific interactions among various ethnic and religious backgrounds, societies and institutions (PART 1/3)	TUNCAY ZORLU
10:50 - 11:15 A189 ID: 580	Professionalization in Science: Tanzimat to Turkish Republic (1839-1946)	Tuğba Yılmaz
11:15 - 11:45 A190 ID: 965	Ahmet Muhtar Pasha's astrolobe making manuel: Riyaz al-Mukhtar	Emirhan Tezer

Tuesday, July 27, 2021 10:00 – 12:00

Virtual Hall 6

Symposium (Part 2/3) Science and literature in small and large scales (Commission on Science and Literature) - ID 271

Symposium organizer: George N. Vlahakis, John Holmes

Chair: Ida Stamhuis

10:00 - 10:30 A191 ID: 686	What postage stamps can tell us about the scientific instruments?	Panagiotis Lazos
10:30 - 11:00 A192 ID: 978	Hands-on knowledge: medieval manuscripts, instruments, and literary interpretation	Samuel GESSNER Janine Rogers

Virtual Hall 6		
11:00 - 11:30 A193 ID: 1082	On the Spanish origins of the "Cientifico/a"	Jorge Alejnadro Laris Pardo
11:30 - 12:00 A194 ID: 1253	Writing a biography of a so-called 'dwarf' in science: the example of the female geneticist Tine Tammes	Ida Stamhuis

Tuesday, July 27, 2021 10:00 – 12:00

Virtual Hall 7		
Symposium (Part 1/4) Placing mathematical knowledge in a world of and beyond nations (IASCUD)- ID 452 Symposium organizer: Michael Barany, Ellen Abrams Chair: Michael Barany		
10:00 - 10:30 A195 ID: 931	The topology of interwar Japan: studying an emerging community institutionally and conceptually	Harald Kümmerle
10:30 - 11:00 A196 ID: 681	From circulation to transfer of knowledge: infinitesimal calculus in Colombia during the 19th century	Bertrand Eychenne
11:00 - 11:30 A197 ID: 613	Computing with WEIZAC in the early days of the State of Israel: Chaim Pekeris's contribution to applied mathematics (1948-1960)	Leo Corry

Tuesday, July 27, 2021 10:00 – 12:00

Virtual Hall 8		
Symposium One hundred years of Niels Bohr's Institute (Commission on the History of Physics) - ID 365 Symposium organizer: Jaume Navarro, Helge Kragh Chair: Roberto Lalli		
10:00 - 10:30 A198 ID: 461	Koç's theory: an unorthodox interpretation of quantum mechanics	Enes Tepe
10:30 - 11:00	The history of the niels bohr institute as seen through the life	Helge Kragh

Virtual Hall 8		
A199 ID: 556	and career of christian møller	
11:00 - 11:30 A200 ID: 1102	The Socrates of physics: looking at Bohr through Wheeler's and Heisenberg's eyes	Stefano Furlan

Tuesday, July 27, 2021 10:00 – 12:00

Virtual Hall 9		
Session VIII (Part 1/2) - Gender Chair: Milada Sekyrková		
10:00 - 10:30 A201 ID: 1248	Moving beyond disciplinary limits and gender role in Spain: C. Arenal (1820-1893) on psychology	Annette Mülberger
10:30 - 11:00 A202 ID: 1148	Degeneration, Gender, and German Immigration: the case of Elza (Rio de Janeiro, 1920s)	Pedro Felipe Muñoz
11:00 - 11:30 A203 ID: 1168	Cotton, makeup and a prosthetic penis. Male and female trans* embodiment techonologies in the mid-twentieth century in Argentina	Patricio Simonetto

Tuesday, July 27, 2021 10:00 – 12:00

Virtual Hall 11		
Symposium (3/7) 16th Annual Symposium of the Social History of Military Technology (ICOHTEC) - ID 126 Symposium organizer: Barton C. Hacker, Ciro Paoletti		
10:00 - 10:30 A204 ID: 849	Ottoman ıntelligence and weaponry	SOMER ALP ŞİMŞEKER
10:30 - 11:00 A205 ID: 541	The jeune école and the development of China's naval defense, 1870s-1890s	Mingyang LI
11:00 - 11:30	Beyond the usual Verdächtige - Military innovation in	Jorit Wintjes

Virtual Hall 11		
A206 ID: 141	Central Europe from the Vereinsgewehr to the Feldl machine gun	
11:30 - 12:00 A207 ID: 961	Technology and french colonial warfare 1871-1914	William Dean

Tuesday, July 27, 2021 10:00 – 12:00

Virtual Hall 12		
Symposium (Part 1/2) DISHAS and recent research on the history of astronomical tables: Latin, Sanskrit and Chinese sources (CHAMA) - ID 76 Symposium organizer: Matthieu Husson, Clemency Montelle Chair: Nick Jacobson		
10:00 - 10:30 A208 ID: 108	Editing and analysing John of Lignères' Tabule magne with DISHAS	Matthieu Husson
10:30 - 11:00 A209 ID: 145	What does the seven metre long 18th century Sanskrit astrological scroll contribute to our understanding of astronomical ideas from western India ?	Aditya Jha
11:00 - 11:30 A210 ID: 146	Tables, calculations and calendars in a time of crisis: the production and public consumption of astronomy in China, 1664-1669.	Christopher Cullen

Tuesday, July 27, 2021 10:00 – 12:00

Virtual Hall 13		
Session II (Part 2/3) - Biological Sciences Chair: Jindřich Brejcha		
10:00 - 10:30 A211 ID: 1001	The dwarf that created a giant industry: The culture of dwarf mulberry tree and its spreading in China	Chuan-hui Mau
10:30 - 11:00 A212 ID: 1032	The founders of Romanian biological oceanography - Emil Racovitza, Ioan Borcea and Grigore Antipa	Alexandru Ș. Bologa

Virtual Hall 13		
11:00 - 11:30 A213 ID: 1182	D'Arcy Thompson, civic science, and fin-de-siècle Darwinism. A case study of scientific and social change	Giuliano Pancaldi

Tuesday, July 27, 2021 11:30 – 12:00

Virtual Hall 10
Informational session (Commission on the History of Metereology and Commission on the History of Geography) Chair: Marcella Schmidt di Friedberg

Tuesday, July 27, 2021 13:00 – 15:00

Virtual Hall 1		
Symposium (Part 2/3) Knowledge of the heavens in transcultural perspectives : the circulation of astronomy and astrology between civilizations - ID 143 Symposium organizer: Weixing Niu, Christopher Cullen Chair: Christopher Cullen		
13:00 - 13:30 A214 ID: 167	Who Are the of Indian Astrology Text in the Chinese Tripiṭaka?	Liqun ZHOU
13:30 - 14:00 A215 ID: 154	On contemporary epochs in Chinese calendrical systems and their possible foreign origin	Weixing Niu
14:00 - 14:30 A216 ID: 157	Ibn al-Zarqālluh's discovery of the annual equation of the moon	Seyyed Mohammad Mozaffari
14:30 - 15:00 A217 ID: 397	Al-Bīrūnī's interpretation and revision on Indian mathematical astronomy in "India"	Yue PAN

Tuesday, July 27, 2021 13:00 – 15:00

Virtual Hall 2
Symposium (Part 1/2) Under Tropical Skies: Relocating Giants and Dwarfs in Meteorology (International

Virtual Hall 2		
Commission on the History of Meteorology) - ID 24 Symposium organizer: Fiona Williamson, Ruth Morgan		
13:00 - 13:30 A218 ID: 64	Defining drought and understanding tropical climate: the place of meteorological observations in the understanding of weather stations in northeastern Brazil (1850-1920)	Almir Leal de Oliveira
13:30 - 14:00 A219 ID: 36	Connecting Australia to the World: Darwin as a meteorological hub in the continent's tropics	Ruth Morgan
14:00 - 14:30 A220 ID: 62	Joanne Simpson's hot tower hypothesis and the history of tropical meteorology: The atmosphere is stable -- except when it isn't	James Fleming

Tuesday, July 27, 2021 13:00 – 15:00

Virtual Hall 3		
Symposium (Part 1/2) Localising Global Technical Knowledge: Founders and Educators of Engineering Schools and Universities in Modern China, c. 1850-1950s (ICOHTEC) - ID 147 Symposium organizer: Hailian Chen, Lisheng Feng, Wolfgang König		
13:00 - 13:30 A221 ID: 540	Training modern Chinese naval engineers in a French way: Fuzhou navy yard (1866–1907) and its educators and students	Mingyang LI
13:30 - 14:00 A222 ID: 165	Pioneers of Educating China's Technical Elites: An Official-Industrialist Sheng Xuanhuai (1844–1916) and His Educational Enterprises	Hailian Chen
14:00 - 14:30 A223 ID: 261	The civil engineer Ling Hongxun (1894–1981) as an educator	Thorben Pelzer
14:30 - 15:00 A224 ID: 909	Commentation and Discussion: Understanding Chinese Engineering Education in a Comparative Perspective (1)	Wolfgang König

Tuesday, July 27, 2021 13:00 – 15:00

Virtual Hall 4

Virtual Hall 4		
Session IX - Meteorology Chair: Takehiko Hashimoto		
13:00 - 13:30 A225 ID: 1064	Different views of scientific debate on climate change and its significance for public training	Zhenghong Chen
13:30 - 14:00 A226 ID: 1074	Defender and Expositor of the Bergen Methods of Synoptic Analysis: Bergeron's "Three-Dimensionally Combining Synoptic Analysis"	David Schultz
14:00 - 14:30 A227 ID: 1161	Reevaluating the roles of the Kaitakushi's Japanese assistant professors and officers in the history of meteorology	Kae Takarabe
14:30 - 15:00 A228 ID: 1211	"Distributed authority and the global atmosphere: the role of telecommunications in late nineteenth-century international meteorology"	Claire Oliver

Tuesday, July 27, 2021 13:00 – 15:00

Virtual Hall 5		
Symposium (Part 2/3) Reflections of science and technology in the Ottoman Empire: scientific interactions among various ethnic and religious backgrounds, societies and institutions - ID 437 Symposium organizer: Tuncay Zorlu, Efthymios Nicolaidis Chair: Tuncay Zorlu		
13:00 - 13:30 A229 ID: 618	The Birth of Modern Meteorology in the Ottoman Empire in the Second Half of the Nineteenth Century (1854-1894)	Saltuk Duran
13:30 - 14:05 A230 ID: 875	Buy or make dilemma in history: technology transfers and military innovations in ottoman empire during 18th and 19th centuries	Melikşah Kaçar
14:05 - 14:30 A231 ID: 577	E-POSTER The Initiative on "Aerial Telegraph" in the Ottoman Empire	Mustafa Kacar

Tuesday, July 27, 2021 13:00 – 15:00

Virtual Hall 6		

Virtual Hall 6		
Symposium (Part 2/4) The materiality of knowledge circulation between China and Europe: physical formats, epistemic genres, spatial localities (16th-18th century) (ISHEASTM) - ID 32 Symposium organizer: Huiyi Wu, Marta Hanson Chair: Marta Hanson		
13:00 - 13:30 A232 ID: 100	Knowledge embodied in objects: the transformative circulation of enamel between Europe and China in the late 17th and 18th century	Catherine JAMI Bing Zhao
13:30 - 14:00 A233 ID: 51	Tracing innovations and technology exchanges between Europe and China. Enamelled objects at the 17th-18th century turn	Philippe COLOMBAN Burcu Kırmızı
14:00 - 14:30 A234 ID: 449	Samples, books and maps: the meandering routes of mineral knowledge between Macao and Paris	Huiyi Wu
14:30 - 15:00 A235 ID: 71	The dissemination of western essential oil knowledge and distillation techniques in late Ming and early Qing China	Chengsheng Sun

Tuesday, July 27, 2021 13:00 – 15:00

Virtual Hall 7		
Symposium (Part 2/4) Placing mathematical knowledge in a world of and beyond nations (IASCUD) - ID 454 Symposium organizer: Michael Barany, Ellen Abrams Chair: Michael Barany		
13:00 - 13:30 A236 ID: 830	From the local to the global: connecting the evolution of statistical thought and practice in eighteenth century Europe	Adam Dunn
13:30 - 14:00 A237 ID: 711	International mathematics in literature: the Oulipo's mathematical connections	Natalie Berkman
14:00 - 14:30 A238 ID: 895	Emphatic adverbs, proper nouns, and the disciplinary grammar of international mathematics	Michael Barany

Tuesday, July 27, 2021 13:00 – 15:00

Virtual Hall 8

Symposium (Part 4/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 207

Chair: Paolo Brenni, Paolo Brenni

Symposium organizer: Janet Laidla

13:00 - 13:30 A239 ID: 425	A matter of trust and control: Questioning the precision of 'precision clocks' in 18th-century observatories	Sibylle Gluch Michael Korey
13:30 - 14:00 A240 ID: 295	Determining, keeping and transmitting time. A century of famous and forgotten precision clocks at the Neuchâtel observatory (1858-1958)	Julien Gressot Romain Jeanneret
14:00 - 14:30 A241 ID: 1023	Under the microscope: Making minerals visible in mineralogy and popular science in modern China	Xi Ma
14:30 - 15:00 A242 ID: 338	An Oscilloscope and a Life: the Beginning of China's Electronic Measuring Instruments Field	Ke Zhao

Tuesday, July 27, 2021 13:00 – 15:00

Virtual Hall 9

Session VIII (Part 2/2) - Gender

Chair: Soňa Štrbáňová

13:00 - 13:30 A243 ID: 1171	Identity and Experiment: Female Psychologist's Reflections on Identity and Their Role in Experimental Styles, Germany 1920s	Laurens Schlicht
13:30 - 14:00 A244 ID: 1224	Breaking borders: a case of Victoria Lady Welby	Konstantin Skripnik
14:00 - 14:30 A245 ID: 1227	Anne Conway on monads	Anastasia Guidi Itokazu
14:30 - 15:00 A246 ID: 1238	Science After the Suffragettes: Trouble at T' Mill for Irene Manton	Nicola Williams

Tuesday, July 27, 2021 13:00 – 15:00

Virtual Hall 10

Symposium Marxism and the history of science: new perspectives - ID 22

Symposium organizer: Constantine (Kostas) Skordoulis, Camilla Royle
Chair: Constantine (Kostas) Skordoulis

13:00 - 13:30 A247 ID: 40	Quantum and materialist dialectic: dynamic and statistical regularity in Hessenian Marxism	Sean Winkler
13:30 - 14:00 A248 ID: 421	Criticism of machinism and modernity	Stany Mazurkiewicz
14:00 - 14:30 A249 ID: 74	"Edgar Zilsel and the Critique of the Mechanical conception of Nature"	Gianna Katsiampoura
14:30 - 15:00 A250 ID: 38	Engels, plagues and 19th century epidemiology	Camilla Royle

Tuesday, July 27, 2021 13:00 – 15:00

Virtual Hall 11

Symposium (4/7) 16th Annual Symposium of the Social History of Military Technology (ICOHTEC) - ID 127

Symposium organizer: Barton C. Hacker, Ciro Paoletti

13:00 - 13:30 A251 ID: 199	The cordite case: understanding the inner technological issues in an otherwise social-legal legacy	yoel bergman
13:30 - 14:00 A252 ID: 139	Victorian science meets the reality of industrial war: H.S.S. Watkin and rangefinding and the Royal Artillery, 1870-1918	Steven Walton

Tuesday, July 27, 2021 13:00 – 15:00

Virtual Hall 12

Virtual Hall 12

E-posters (Part 2/3)

Chair: Vojtěch Pojar

13:00 - 13:10 A253 ID: 1121	E-POSTER Re-evaluating Britannia Bridge: The Historical Development of Bridge-building Technology	Manabu KOBAYASHI
13:10 - 13:20 A254 ID: 1155	E-POSTER Situation of the fight against malaria in Peru (1953)	Irwin Enrique Peralta
13:20 - 13:30 A255 ID: 1214	E-POSTER The origins of the Russian study of Chinese astronomy. Russian astronomer of the 19th century K. Skachkov on the history of Chinese astronomy	Galina Sinkevich
13:30 - 13:40 A256 ID: 1221	E-POSTER SCIENTIFIC RESEARCH, INNOVATIONS AND LABOUR PRODUCTIVITY IN BRITISH AND RUSSIAN MANUFACTURING BEFORE THE GREAT WAR	Dmitrii Saprykin
13:40 - 13:50 A257 ID: 1223	E-POSTER Stanisław Michalski - the founding father of the science of science	Mateusz Hübner
13:50 - 14:00 A258 ID: 1231	E-POSTER Halley's Comet Trail: Transit and Legitimation of astronomical knowledge in Chile (1910)	Verónica Ramírez-Errázuriz

Tuesday, July 27, 2021 15:00 – 16:00

Virtual Hall 13

Presentation - Wiley Digital Archives

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Virtual Hall 13		
15:00 - 15:30 A259 ID: 1329	Uncovering Hidden Stories in the Archives of Learned Societies	Ray Abruzzi

Tuesday, July 27, 2021 15:30 – 17:30

Virtual Hall 1		
Symposium Lives in danger, workplace in decay… „Ordinary" intellectuals of Jewish origin and their fate between 1930s and 1950s - ID 715 Symposium organizer: Ivana Ebelová, Milada Sekyrková		
15:30 - 16:00 A260 ID: 987	A Treasure of the USHMM Archive: Dr. Ilka Dickman	Tereza Kopecká
16:00 - 16:30 A261 ID: 988	Transformation of the students and pedagogical staff of Prague universities in the second half of the 1930s	Ivana Ebelová Milada Sekyrková
16:30 - 17:00 A262 ID: 989	Institute of Light	Vira Gamaliia
17:00 - 17:30 A263 ID: 990	German-Jewish scientists and their fate between 1933 and 1960	Annette B. Vogt

Tuesday, July 27, 2021 15:30 – 17:30

Virtual Hall 2		
Symposium (Part 2/2) Under Tropical Skies: Relocating Giants and Dwarfs in Meteorology (International Commission on the History of Meteorology) - ID 25 Symposium organizer: Fiona Williamson, Ruth Morgan Chair: James R. Fleming		
15:30 - 16:00 A264 ID: 37	The world of filipino weathermen of the manila observatory and the philippine weather bureau, 1884 - 1935	Kerby Alvarez
16:00 - 16:30 A265	Just doing their job: The Hidden Meteorologists of Colonial Hong Kong c. 1883-1914	Fiona Williamson

Virtual Hall 2		
ID: 35		
16:30 - 17:00 A266 ID: 377	Rainfall prediction in post-colonial South Asia: The connected projects of astrology, folklore, and meteorology, 1948-1963	Sarah Carson
17:00 - 17:30 A267 ID: 1297	Dwarfs or Empire Builders? Italian colonial meteorology between the Mediterranean and the Indian Ocean	Angelo Matteo Caglioti

Tuesday, July 27, 2021 15:30 – 17:30

Virtual Hall 3		
Symposium (Part 2/2) Localising Global Technical Knowledge: Founders and Educators of Engineering Schools and Universities in Modern China, c. 1850-1950s (ICOHTEC) - ID 148 Symposium organizer: Hailian Chen, Wolfgang König Chair: Wolfgang König		
15:30 - 16:00 A268 ID: 898	Promoting and Localising Mechanical Engineering Education in Modern China: Liu Xianzhou (1890–1975) and His Pioneering Educational Practices	Lisheng FENG
16:00 - 16:30 A269 ID: 197	Educating Chinese Textile Students between Theoretical Knowledge and Practice: A Comparative Case Study of U.S.- and France-Returned Teachers at Peiyang/Tianjin University in the 1950s	Xuan Su
16:30 - 17:00 A270 ID: 679	Debates on traditional architecture in China: Uncovering the layers of the reception of Liu Dunzhen	Constantin Canavas
17:00 - 17:30 A271 ID: 910	Commentation and Discussion: Understanding Chinese Engineering Education in a Comparative Perspective (2)	Wolfgang König

Tuesday, July 27, 2021 15:30 – 17:30

Virtual Hall 4
Symposium (Part 2/5) Re-scaling & de-centering the history of oceanography: the 'hidden figures' and hidden dimensions of global ocean science (ICHO) - ID 453 Symposium organizer: Penelope K. Hardy, Cornelia Lüdecke

Virtual Hall 4		
Chair: Penelope K. Hardy		
15:30 - 16:00 A272 ID: 945	Debating Value and Purpose: The Inland Ohio- Mississippi River System within Broader Water Networks	Kristen Fleming
16:00 - 16:30 A273 ID: 764	Vulnerable at Sea: Environmental-Health and the Maritime Environment	Katy Kole de Peralta
16:30 - 17:00 A274 ID: 589	De-centering conservation in the Indian Sundarbans Delta: a nexus between global ocean science and competing grounded environmentalities	Amrita Sen
17:00 - 17:30 A275 ID: 646	Knowing the beast: how different styles of population modelling developed in early fisheries science	Jennifer Hubbard

Tuesday, July 27, 2021 15:30 – 17:30

Virtual Hall 5		
Symposium (Part 3/3) Reflections of science and technology in the Ottoman Empire: scientific interactions among various ethnic and religious backgrounds, societies and institutions - ID 602 Symposium organizer: Tuncay Zorlu, Efthymios Nicolaidis Chair: Saltuk Duran		
15:30 - 16:00 A276 ID: 753	Ottoman temporality: towards an understanding of multivalent and multi-cultural temporal reckoning in early ottoman history	Maryam Patton
16:00 - 16:15 A277 ID: 996	E-POSTER The Existential Struggle of The Printing House Against The Verbal Culture and Manuscript Tradition in The Ottoman Empire	Nihal Ozdemir
16:15 - 16:35 A278 ID: 1013	E-POSTER Theoretical Backround of "ilm al-misaha" (science of measure) in the Ottoman Classical Period (1300-1800)	Elif Baga
16:35 - 17:05 A279 ID: 1012	"Ilm al-misaha" through applications: a study of al-misaha manuscripts in the ottoman classical period (1300-1800)	Zehra Bilgin

Tuesday, July 27, 2021 15:30 – 17:30

Virtual Hall 6

Symposium (Part 1/5) Computing in the sciences and in technology. An Aristotelian perspective (HaPoC) - ID 11

Symposium organizer: Arianna Borrelli, Liesbeth De Mol

Chair: Helena Durnová

15:30 - 16:00 A280 ID: 78	Rockets, Engines, Biohybrids: 21st Century Motor and Temporal Regimes	Janina Wellmann
16:00 - 16:30 A281 ID: 256	Conspicuous computing. Organizing the cutting edge of computability (1980-2020)	David Gugerli
16:30 - 17:00 A282 ID: 595	Mainframe computer or programmable pocket calculator? Two calculation tools for two epistemological approaches of computing in French medieval history (1967-1981)	Edgar LEJEUNE

Tuesday, July 27, 2021 15:30 – 17:30

Virtual Hall 7

Symposium (Part 3/4) Placing mathematical knowledge in a world of and beyond nations (IASCUD)- ID 456

Symposium organizer: Michael Barany, Ellen Abrams

Chair: Ellen Abrams

15:30 - 16:00 A283 ID: 824	The Malthus Library: The library as cognitive instrument in the making of the population principle	Kevin Lambert
16:00 - 16:30 A284 ID: 664	The Kitchen and the Dacha: Productive Spaces of Soviet Mathematics	Slava Gerovitch
16:30 - 17:00 A285 ID: 876	Internationalization and the interplay of theory and experiment in 1970s high energy physics	Vitaly Pronskikh
17:00 - 17:30 A286 ID: 879	Can mathematical knowledge be a form of self-knowledge? The case of the late Russian Empire.	Anya Yermakova

Tuesday, July 27, 2021 15:30 – 17:30

Virtual Hall 8

Symposium (Part 5/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 209

Symposium organizer: Janet Laidla

Chair: Alexi Baker, Alexi Baker

15:30 - 16:00 A287 ID: 310	The transformation of a failed scientific instrument: a tool for teaching science, a work of art, and an inspiration for art	Marvin Bolt
16:00 - 16:30 A288 ID: 442	Show, don't tell: the magic lantern and 19th-century science popularisation	Trienke van der Spek
16:30 - 17:00 A289 ID: 287	Play, design, science: spinning tops, crossing spaces, understanding physics	Artemis Yagou
17:00 - 17:30 A290 ID: 968	No future without history	Jan Waling Huisman

Tuesday, July 27, 2021 15:30 – 17:30

Virtual Hall 9

Symposium (Part 1/3) Evolution of mathematics in China: major figures, anonymous contributors, and the giants among them (ICHM) (with IMU)- ID 66

Symposium organizer: Joseph W. Dauben, Shuchun Guo

Brief Introduction: Joseph W. Dauben

Chair: Dahai Zou

15:30 - 16:00 A291 ID: 341	Concerning Classical Chinese Mathematics, We Only Know a Few Bits and Pieces	Shuchun Guo
16:00 - 16:30 A292 ID: 406	Approaching the "True Value" (Mihe 密合) and Cui Chaoqing's Examination of Two Pursuit Problems in the Nine Chapters: "Rushes and Reeds Growing Simultaneously" and "Two Rats Tunneling Through a Wall"	Hongcheng GAO
16:30 - 17:00 A293	Survey of mathematics during the Warring States Period: from bamboo slips to ancient documents of the Qin and Han	Zhaoyang WU

Virtual Hall 9		
ID: 398	dynasties	
17:00 - 17:30 A294 ID: 408	On the Stylization of Traditional Chinese Mathematics	Zelin XU

Tuesday, July 27, 2021 15:30 – 17:30

Virtual Hall 10		
Session X (Part 1/2) - Diplomacy, behavior Chair: Doubravka Olšáková		
15:30 - 16:00 A295 ID: 1190	'Pure and Applied Regulations': The origins and evolution of Portuguese science-based Food Safety legislation (1875-1905)	José Ferraz-Caetano
16:00 - 16:30 A296 ID: 1157	Scientific policies in Brazil under democratic and authoritarian governments after Second World War	Olival Freire Junior
16:30 - 17:00 A297 ID: 942	Anticipating Transformation: Emigrés as cross-bloc Expectation Managers in 1980s Europe	Konrad Sziedat

Tuesday, July 27, 2021 15:30 – 17:30

Virtual Hall 11		
Symposium (Part 3/6) Transportation History: Railway modernisation - infrastructure and motive power (ICOHTEC) - ID 492 Symposium organizer: Timo Myllyntaus, Hugo Pereira Chair: Hugo Pereira		
15:30 - 16:00 A298 ID: 799	Reservation systems for passenger railway travel	Reima Suomi

Tuesday, July 27, 2021 15:30 – 17:30

Virtual Hall 12

Virtual Hall 12		
Session III (Part 3/3) - Geography Chair: Marek Ďurčanský		
15:30 - 16:00 A299 ID: 1240	Wahlenberg's forgotten map: barometer, vegetation and colour layer tinting	Zsolt Győző Török
16:00 - 16:30 A300 ID: 1207	Alfred Russel Wallace and the authority of field observation: the making of a giant of the ethnography of the Amazon	Victor Rafael Limeira-DaSilva
16:30 - 17:00 A301 ID: 1277	Scholars who travelled and explorers we remember. Perspectives on the character and crew of the Nordenskiöld expeditions in the 1860's and 1870's	Päivi Maria Pihlaja

Tuesday, July 27, 2021 18:00 – 20:00

Virtual Hall 1		
Symposium (Part 2/3) CHCMS (History of Chemistry and Molecular Sciences) - ID 934 Symposium organizer: Brigitte Van Tiggelen, Yoshiyuki Kikuchi Chair: Annette Lykknes		
18:00 - 18:30 A302 ID: 1302	Tacit Conventions and the Making of the Modern Chemical Notation: How Editors, Publishers, and Printers of Scientific Journals Shaped Structural Formulae in the 1870s and 1880s	Konstantin S. Kiprijanov
18:30 - 19:00 A303 ID: 1303	Color and oxidation: Nonstandard tools in efforts to determine structure and size of aniline polymers in the early 20th century	Seth Rasmussen
19:00 - 19:30 A304 ID: 1304	Patenting Agent Orange: Chemical Classification, Novelty, and the Military-Industrial Complex in the Cold War United States	Alison McManus
19:30 - 20:00 A305 ID: 1305	From parasitic to indispensable: synchrotron radiation sources in biological research	Apostolos Gerontas

Tuesday, July 27, 2021 18:00 – 20:00

Virtual Hall 2

Virtual Hall 2		
Symposium Empire of knowledge: South Asia, 1850-1971 (Science and Empire Commission) - ID 502 Symposium organizer: Prakash Kumar, Deepak Kumar Chair: Prakash Kumar, Deepak Kumar		
18:00 - 18:30 A306 ID: 611	Western Sanitary Science and Hygienic Practices in South India, 1850-1920	B Eswara Rao
18:30 - 19:00 A307 ID: 590	Evolution of electrical engineering in colonial Calcutta: Bhadralok aspirations on academia and industry interface, 1880s – 1940s	Suvobrata Sarkar
19:00 - 19:30 A308 ID: 603	Changing geographies, redefining disease: migration and modernisation in ayurveda, 1902-1960	Burton Cleetus
19:30 - 20:00 A309 ID: 586	Towards a new modern: The land grant model and India's rural universities	Prakash Kumar

Tuesday, July 27, 2021 18:00 – 20:00

Virtual Hall 3		
Symposium (Part 1/3) Great to small: spatial and temporal scales in the history of the geosciences (INHIGEO) (with IUGS) - ID 504 Symposium organizer: Marianne Klemun, Gregory A Good Chair: Gregory A Good		
18:00 - 18:30 A310 ID: 941	Powers of Scaling: Conceptual and Sociopolitical Considerations in A. P. Coleman's Mapping of the Sudbury Region	Ernst Hamm
18:30 - 19:00 A311 ID: 758	From rocks to mountains: the use of 'small' specimens for the 'great' history of the Earth during the 18th century	Ezio Vaccari
19:00 - 19:30 A312 ID: 949	Macro-evolution vs micro-evolution in Palaeontology. The 1970's "Punctuated Equilibria revolution" and its scientific/political issues	Claudine COHEN
19:30 - 20:00 A313	Scaling down the earth's history: visual materials for popular education by Nerée Boubée (1806-1862).	Silvia Figueiroa

Virtual Hall 3		
ID: 667		

Tuesday, July 27, 2021 18:00 – 20:00

Virtual Hall 4		
Symposium (Part 3/5) Re-scaling & de-centering the history of oceanography: the 'hidden figures' and hidden dimensions of global ocean science (ICHO) - ID 450 Symposium organizer: Penelope Hardy, Cornelia Lüdecke Chair: Helen Rozwadowski		
18:00 - 18:30 A314 ID: 591	"Unnamed marine animals" –oceanic microfauna, collection ecologies and hidden knowledge makers, ca. 1750-1850	Dominik Huenniger
18:30 - 19:00 A315 ID: 835	Science from the quarterdeck: Naval-scientific networks and the 1870s Challenger Expedition	Penelope Hardy
19:00 - 19:30 A316 ID: 797	"So-called" coral reefs: Algae, transnational networks and the biological turn in reef science 1896-1928	Emily Hutcheson
19:30 - 20:00 A317 ID: 908	Circulating coral: Tracing the Pacific origins of captive coral systems	Sam Muka

Tuesday, July 27, 2021 18:00 – 20:00

Virtual Hall 5		
Session XI Computers Chair: Jan Kotůlek		
18:00 - 18:30 A318 ID: 1235	The birth of a metaphor: the golden age of 'artificial intelligence' research 1956-1976	Joseph Wilson
18:30 - 19:00 A319 ID: 1066	The indispensable modern – the advertisements of computing technologies and their representations during redemocratization process in Brazil (1977-1985)	Marcelo Vianna
19:00 - 19:30	Female computers and more at the International Latitude	Yukie Baba

Virtual Hall 5		
A320 ID: 1162	Observatory of Mizusawa	
19:30 - 20:00 A321 ID: 1192	Writing the history of Artificial Intelligence from a peripheral/southern context: The experience from a non-anglophone European country	Konstantinos Sakalis

Tuesday, July 27, 2021 18:00 – 20:00

Virtual Hall 6		
Symposium (Part 2/5) Computing in the sciences and in technology. An Aristotelian perspective (HaPoC) - ID 12 Symposium organizer: Arianna Borrelli, Liesbeth De Mol Chair: Arianna Borrelli		
18:00 - 18:30 A322 ID: 83	Diagrams vs equations in circuit design	Maarten Bullynck
18:30 - 19:00 A323 ID: 252	There is no hardware either: virtual machines and practical languages	Mark Priestley
19:00 - 19:30 A324 ID: 264	There will be a time-fight tomorrow: Old problems in new logics	Troy Astarte
19:30 - 20:00 A325 ID: 1335	informative HAPOC meeting	Liesbeth De Mol

Tuesday, July 27, 2021 18:00 – 20:00

Virtual Hall 7		
Symposium (Part 4/4) Placing mathematical knowledge in a world of and beyond nations (IASCUD)- ID 457 Symposium organizer: Michael Barany, Ellen Abrams Chair: Ellen Abrams		
18:00 - 18:30	Cold War story-telling in the mathematical communities of the	Barbara Walker

Virtual Hall 7		
A326 ID: 885	United States and the Soviet Union	
18:30 - 19:00 A327 ID: 848	Global mathematics and local masculinities	Ellen Abrams
19:00 - 19:30 A328 ID: 822	Toward a history of math anxiety: From oral examination to written testing in American redefinitions of student performance, 1890s-1920s	Andrew Fiss
19:30 - 20:00 A329 ID: 897	End-of-symposium comment and discussion, moderated by the symposium organizers	Michael Barany Ellen Abrams

Tuesday, July 27, 2021 18:00 – 20:00

Virtual Hall 8		
Symposium (Part 6/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 210 Symposium organizer: Janet Laidla Chair: Michael Korey, Michael Korey		
18:00 - 18:30 A330 ID: 520	Back into the laboratory from 19th century toystores – the curious case of the Zeiss stereotelemeter	Andreas Junk
18:30 - 19:00 A331 ID: 371	The Turkification of Astronomical Instrumentation in Ottomans between the 15th and 19th centuries	Merve Sandallı
19:00 - 19:30 A332 ID: 536	Evolution of astrolabes from planispheric to universal and its transmission from the Islamic west to Islamic east	Saliha Bütün
19:30 - 20:00 A333 ID: 930	Jagiellonian University mechanicians –their workshop and instruments – 19th-20th century	Ewa Wyka

Tuesday, July 27, 2021 18:00 – 20:00

Virtual Hall 9
Symposium (Part 2/3) Evolution of mathematics in China: major figures, anonymous contributors, and

Virtual Hall 9		
the giants among them (ICHM) (with IMU) - ID 69 Symposium organizer: Joseph W. Dauben, Shuchun Guo		
18:00 - 18:30 A334 ID: 192	A comparative examination of epistemological values utilized by Chinese mathematicians from Liu Hui to Mei Wending in solving fangcheng problems	Jiang-Ping Jeff Chen
18:30 - 19:00 A335 ID: 195	Pitiscus' numerical solution for sin 1° and his influence on Chinese mathematic	Jie Dong Yuan Yuan Guo
19:00 - 19:30 A336 ID: 344	The Position and Influence of the 13th-century Chinese Mathematician Yang Hui in the History of Chinese Mathematics	Shirong Guo
19:30 - 20:00 A337 ID: 323	New Arguments on the Relation Between Geng Shouchang and the Compilation of the Nine Chapters on Mathematical Procedures	Dahai Zou

Tuesday, July 27, 2021 18:00 – 20:00

Virtual Hall 10		
Session X (Part 2/2) - Diplomacy, behavior Chair: Doubravka Olšáková		
18:00 - 18:30 A338 ID: 1132	Utilization of academic models in modern industrial fields (sericulture) at the beginning of the 20th century	Yurika Saito
18:30 - 19:00 A339 ID: 1244	Giants and dwarfs: changing image of expert, his/her place and role in science history	Natalia Knekht
19:00 - 19:30 A340 ID: 1033	A Preliminary Study on Overseas-returned Chinese Architects in the First Half of 20th Century——based on Academic Pedigree	Mo Wang

Tuesday, July 27, 2021 18:00 – 20:00

Virtual Hall 12
Symposium (Part 2/2) DISHAS and recent research on the history of astronomical tables: Latin, Sanskrit

Virtual Hall 12		
and Chinese sources (CHAMA) - ID 77 Symposium organizer: Matthieu Husson, Benno van Dalen Chair: Matthieu Husson		
18:00 - 18:30 A341 ID: 1327	Shanati: A Project to Reconstruct the 1st Millennium BCE Ancient Babylonian Chronology to the Day	David Danzig
18:30 - 19:00 A342 ID: 114	The numerical differences of the two versions of Ḥabash al-Ḥasib's astronomical tables	Johannes Thomann
19:00 - 19:30 A343 ID: 317	The emergence of auxiliary astronomical tables in medieval Europe	Glen Van Brummelen
19:30 - 20:00 A344 ID: 1325	Demonstration of DISHAS, Digital Information System for the History of Astral Sciences	Segolene Albouy

Tuesday, July 27, 2021 18:00 – 20:00

Virtual Hall 13		
Session II (Part 3/3) - Biological Sciences Chair: Zuzana Schierová		
18:00 - 18:30 A345 ID: 1063	Morphine, alcohol, and the victorious body: how intoxicants intersected bodies and minds in the development of the biological subject	Matthew Perkins-McVey
18:30 - 19:00 A346 ID: 1156	Biology in BAAS during the nineteenth century: T.H. Huxley and the ephemeral life of a discipline	Juan Manuel Rodriguez-Caso
19:00 - 19:30 A347 ID: 1159	Julian Huxley, UNESCO and transhumanism: an outline of a biopolitical proposal	Paulina Cruz-Castañeda

Tuesday, July 27, 2021 20:00 – 21:00

Virtual Hall 3

Virtual Hall 3
IDTC business meeting

Wednesday, July 28, 2021 10:00 – 12:00

Virtual Hall 1		
Symposium (Part 1/4) Mathematical proofs and styles of reasoning: East vs. West - ID 49 Symposium organizer: Jens Lemanski, Ioannis Vandoulakis, Eberhard Knobloch Chair: Ioannis Vandoulakis		
10:00 - 10:30 A348 ID: 94	Symbolic algebra as a synthesis of East and West	Ladislav Kvasz
10:30 - 11:00 A349 ID: 238	Geometric reasoning and arithmetic reasoning in the medieval tradition of Euclid's Elements	Leo Corry

Wednesday, July 28, 2021 10:00 – 12:00

Virtual Hall 2		
Symposium (Part 3/3) Knowledge of the heavens in transcultural perspectives : the circulation of astronomy and astrology between civilizations - ID 144 Symposium organizer: Weixing Niu, Christopher Cullen Chair: Yunli Shi		
10:00 - 10:30 A350 ID: 152	The Transmission of European Medical Astrology in Qing China	Haohao Zhu
10:30 - 11:00 A351 ID: 153	A Primary Research on the Calculating Method of the Solar Eclipses in a Chinese Version of the Tychonic System (Chóngzhēn lìshū 崇禎曆書)	Longfei Chu Chen Ji
11:00 - 11:30 A352 ID: 179	A public cosmology lecture with a clockwork astronomical model in 18th century Japan	Ryuji Hiraoka
11:30 - 12:00 A353	The Non-Ptolemaic Islamic Star Tables in the Huihui-lifa and the Sanjufini-zij: Focusing on the analysis of precession and epoch	Eun-Hee Lee

Virtual Hall 2		
ID: 472		

Wednesday, July 28, 2021 10:00 – 12:00

Virtual Hall 3		
Symposium (Part 2/2) To explore from West to East: persons, methods and results - ID 82 Symposium organizer: Tatiana Feklova, Yuko Takigawa, Tatiana Feklova		
10:00 - 10:30 A354 ID: 102	Reconstructing British and Russian envoys/expeditions to Japan at the end of the 18th century in relation to Daikokuya Kodayu	Yuko Takigawa
10:30 - 11:00 A355 ID: 131	Development of one of the world's largest zoological collections: collecting for Zoological museum in Stankt-Petersburg in 19th - early 20th century	Nadezhda Slepkova
11:30 - 12:00 A356 ID: 458	Meteorological observations in research programs of the Russian expeditions to Central Asia at the turn of the 20th century	Tatiana Yusupova

Wednesday, July 28, 2021 10:00 – 12:00

Virtual Hall 4		
Symposium (Part 1/2) New perspectives: differentiating cultures in ancient mathematics (IASCUD) - ID 527 Symposium organizer: Agathe Keller, Fanglei Zheng Chair: Fanglei Zheng		
10:00 - 10:30 A357 ID: 608	Cultures of quantification and computation as testified by the Śulbasūtras	Keller Agathe
10:30 - 11:00 A358 ID: 621	Variety in a uniform tradition: A comparison of metrology and mathematical education in Old Babylonian sources	Robert Middeke-Conlin
11:00 - 11:30 A359 ID: 661	An analysis of the Double-Fourteenth Book in Billingsley's translation of Euclid’s Elements	Jingbo CAO
11:30 - 12:00	Differentiating two practices and the underlying epistemic	Shuyuan Pan

Virtual Hall 4		
A360 ID: 890	principles in the "rule of three" procedures in China	

Wednesday, July 28, 2021 10:00 – 12:00

Virtual Hall 5		
Symposium Military research and the militarization of research in Cold War Europe - ID 346 Symposium organizer: Per Lundin, Robert Bud Chair: Robert Bud		
10:00 - 10:30 A361 ID: 405	The military origin of computing and long-term planning in Cold War Sweden	Eric Bergelin
10:30 - 11:00 A362 ID: 736	The hidden university: The military research institutes as knowledge producers in Cold War Sweden	Niklas Stenlås
11:00 - 11:30 A363 ID: 944	"Entirely at your service, except [….]". Dutch scientists and military research during the Cold War	Friso Hoeneveld
11:30 - 12:00 A364 ID: 947	Industrial and military research in the Versuchsanstalt Pibrans during Nazi occupation and its Cold War continuation	Jan Kotůlek

Wednesday, July 28, 2021 10:00 – 12:00

Virtual Hall 6		
Session XII - History of Bibliography Chair: Birute Railene		
10:00 - 10:30 A365 ID: 1228	Retrospective bibliographical index - a universal source for history of science	Birute Railiene
10:30 - 11:00 A366 ID: 1232	Polish Current Bibliography of the History of Science and Technology at the Institute of the History of Science, PAS	Jan Kozakowski

Wednesday, July 28, 2021 10:00 – 12:00

Virtual Hall 7

Symposium Environmental policy, mining, and recultivation in East and West Germany. Brown coal of the Lausitz, Wismut, and the Ruhr (1949-1989/2000) (ICOHTEC) - ID 522

Symposium organizer: Helmut Maier, Ewelina Twardoch-Ras

Chair: Helmut Maier

10:00 - 10:30 A367 ID: 697	The coal mining spoil heaps in the Ruhr area and their integration in the landscape	Ron-David Heinen
10:30 - 11:00 A368 ID: 705	Soil and socialism. Recultivation of lignite mining in the German Democratic Republic	Martin Baumert
11:00 - 11:30 A369 ID: 734	Environmental Policy and the Uranium Ore Mining in East Germany, 1946-1990	Sabine Loewe-Hannatzsch

Wednesday, July 28, 2021 10:00 – 12:00

Virtual Hall 9

Symposium (Part 3/3) Great to small: spatial and temporal scales in the history of the geosciences (INHIGEO) (with IUGS) - ID 505

Symposium organizer: Marianne Klemun, Gregory A Good

Chair: Gregory A Good, Marianne Klemun

10:00 - 10:30 A370 ID: 671	Scale in the history of geology: dinosaurs and ostracods	Michiko Yajima
10:30 - 11:00 A371 ID: 889	The elaboration of the concept of Gondwana and the making of the scientific discourse for extractivism	Mariana Ferrari Waligora
11:00 - 11:30 A372 ID: 911	The Rearrangement of Scaling and Networking: Cosmographical Worldview Evolved into Geological Mapping	Toshihiro Yamada

Wednesday, July 28, 2021 10:00 – 12:00

Virtual Hall 10

Virtual Hall 10		
Symposium (1/2) Women and academic careers in Central and Eastern Europe after the 2nd World War (1945 –1968). S. held in honor of S. Štrbáňová (Com. on Wom. and Gender in Sci., Tech. and Med.) - ID 17 Symposium organizer: Adéla Jůnová Macková, Željko Oset Chair: Željko Oset		
10:00 - 10:30 A373 ID: 95	Female scientists at the newly established institutes of Slovene Academy of Sciences and Arts (1945-1960)	Željko Oset
10:30 - 11:00 A374 ID: 23	Female scientists and the Academy of Science in 1950s and 1960s	Adéla Jůnová Macková
11:00 - 11:30 A375 ID: 26	Heading a communist hierarchy: The case of Savka Dabčević Kučar	Marijana Kardum
11:30 - 12:00 A376 ID: 392	Female scientists in Berlin (East) at the University and in the Academy of Sciences (1946-1972)	Annette B. Vogt

Wednesday, July 28, 2021 10:00 – 12:00

Virtual Hall 11		
Symposium (5/7) 16th Annual Symposium of the Social History of Military Technology (ICOHTEC) - ID 128 Symposium organizer: Barton C. Hacker, Ciro Paoletti		
10:00 - 10:30 A377 ID: 149	From death rays to the Bolton Paul Defiant: a radical reinterpretation of interwar military technical development	David Zimmerman
10:30 - 11:00 A378 ID: 314	Giants in between. Ernst Mach's research within the framework of civil and military r&i of the Austrian-Hungarian Empire	Regina Jonach
11:00 - 11:30 A379 ID: 555	The photomosaic map, also known as the WWI "Flying Cinema"	Noemi Quagliati

Wednesday, July 28, 2021 10:00 – 12:00

Virtual Hall 12

Symposium (Part 1/2) Scientific Instruments and Literature (Commission on Science and Literature) - ID 288

Symposium organizer: George N. Vlahakis, Janet Laidla

Chair: George N. Vlahakis

10:00 - 10:30 A380 ID: 732	Early 70s, Nançay is the setting for a film and a novel	Jean Davoigneau
10:30 - 11:00 A381 ID: 806	The Expo 58 as a global event for the development of scientific instruments in the Cold War and its use in spy novels.	GEORGE VLAHAKIS

Wednesday, July 28, 2021 13:00 – 14:00

Virtual Hall 1

Pacific Circle Committee Meeting

Wednesday, July 28, 2021 13:00 – 15:00

Virtual Hall 2

Symposium (Part 3/4) The materiality of knowledge circulation between China and Europe: physical formats, epistemic genres, spatial localities (16th-18th century) (ISHEASTM) - ID 33

Symposium organizer: Huiyi Wu, Marta Hanson

Chair: Marta Hanson

13:00 - 13:30 A382 ID: 52	From Text to Map: Maps and Geographies as Catalysts for Cross-cultural Contact in Late Ming China	Mario Cams
13:30 - 14:00 A383 ID: 59	From maps to texts: knowledge transition in early Jesuit writings	Anna Strob
14:00 - 14:30 A384 ID: 63	Monuments, hermeneutics, or astronomy? China and the invention of 'philosophical history'	Gianamar Giovannetti-Singh

Wednesday, July 28, 2021 13:00 – 15:00

Virtual Hall 3

Symposium Astronomical tables and canons in the Alfonsine tradition - ID 115

Symposium organizer: Nicholas Jacobson, Stefan Zieme

13:00 - 13:30 A385 ID: 597	Building new astronomical tools: a mise en perspective of the equation of time in Lewis of Caerleon's astronomical works	Laure Miolo
13:30 - 14:00 A386 ID: 598	The hierarchical structure of tables: Lewis of Caerleon on the equation of time	Stefan Zieme
14:00 - 14:30 A387 ID: 617	Planetary latitudes tables in Conrad Heingarter's astronomical manuscripts	Camille Bui
14:30 - 15:00 A388 ID: 639	Conrad Heingartner's notes on canons for finding planetary latitudes	Nicholas Jacobson

Wednesday, July 28, 2021 13:00 – 15:00

Virtual Hall 4

Symposium (Part 2/2) New perspectives: differentiating cultures in ancient mathematics (IASCUD) - ID 529

Symposium organizer: Agathe Keller, Fanglei Zheng

Chair: Agathe Keller

13:00 - 13:30 A389 ID: 635	Using the square or using the circle? Different proofs on the "Broken Bamboo" Problem	LU PENG
13:30 - 14:00 A390 ID: 692	Mathematical cultures according to observers and to actors: The historiography of number systems and arithmetic	Karine Chemla
14:00 - 14:30 A391 ID: 833	19th Century French Scholars' observations on the Chinese abacus and its cultural background	Yan Wu Zhihui Chen
14:30 - 15:00 A392	19th Century French Scholars' observations on the Chinese abacus and its cultural background	Yan Wu Zhihui Chen

Virtual Hall 4		
ID: 834		
14:30 - 15:00 A393 ID: 874	How many mathematical cultures are there in the works of Fibonacci? An alternative perspective on differentiating cultures in mathematical practices	Fanglei Zheng

Wednesday, July 28, 2021 13:00 – 15:00

Virtual Hall 5		
Session VI (Part 3/3) - Academies, Societies, Laboratories and other Institutions - Laboratories Chair: Marek Ďurčanský		
13:00 - 13:30 A394 ID: 1104	A glance at Emil Artin's mathematical laboratory – his letters to his doctoral father Gustav Herglotz	Peter Ullrich
13:30 - 14:00 A395 ID: 1197	Visiting and working with a giant: Cohips and acknowledgements at the Zoophysiological Laboratory of August Krogh	Allan Rye Lyngs

Wednesday, July 28, 2021 13:00 – 15:00

Virtual Hall 6		
E-posters (Part 3/3) Chair: Jiří Janáč		
13:00 - 13:10 A396 ID: 1256	E-POSTER (De)colonizing climate change	Siddarth Venkatesh Agnidh Ghosh
13:10 - 13:20 A397 ID: 1257	E-POSTER How to teach experiments in times of distance learning	Susanne Gruber
13:20 - 13:30 A398 ID: 1265	E-POSTER Pierre Duhem Forgotten? A Reply from an Epistemological Point of View	Mirella Fortino
13:30 - 13:40 A399 ID: 1237	E-POSTER Early history and development of high voltage electron microscope in Japan	Kotaro Kuroda

Virtual Hall 6		
13:40 - 13:50 A400 ID: 1270	E-POSTER Ancient and Early Modern Geometrical Optics	Piotr Błaszczyk
13:50 - 14:00 A401 ID: 1272	E-POSTER European scientists-researchers of the Caucasus (XVIII-XIX centuries)	Zulfira Gagaeva
14:00 - 14:10 A402 ID: 1274	E-POSTER and patentees in aeronautics and aviation, 1880-1914	Peter B Meyer
14:10 - 14:20 A403 ID: 1282	E-POSTER Michelangelo, Copernicus and the Sistine Chapel: the Last Judgment Decoded	Valerie Shrimplin

Wednesday, July 28, 2021 13:00 – 15:00

Virtual Hall 7
CHAMA Meeting

Wednesday, July 28, 2021 13:00 – 15:00

Virtual Hall 8		
Symposium (Part 7/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 211 Chair: Martin Weiss, Martin Weiss Symposium organizer: Janet Laidla		
13:00 - 13:30 A404 ID: 289	The Very First Use of Sextants and Octants in Turkish Marine in the 18th and 19th Centuries	Hakan SEMİZ
13:30 - 14:00 A405 ID: 479	Scale for the Setting: The Tension Between Accuracy and Ease of Use in Exploration c1830-1850	Jane Wess
14:00 - 14:30 A406 ID: 432	London as a stopover for Russian circumnavigations in the first half of the 19th century	Feliks Gornischeff
14:30 - 15:00	Britain's worldwide seismograph network and its private	Alexandra Rose

Virtual Hall 8		
A407 ID: 275	funders, 1896–1932	

Wednesday, July 28, 2021 13:00 – 15:00

Virtual Hall 9		
Symposium (Part 2/3) Great to small: spatial and temporal scales in the history of the geosciences (INHIGEO) (with IUGS) - ID 506 Symposium organizer: Marianne Klemun, Gregory A Good Chair: Marianne Klemun, Gregory A Good		
13:00 - 13:30 A408 ID: 656	Henry Thomas De la Beche's (1796-1855) Duria antiquior: temporal visualization within the golden age of geology (1788-1840)	Renee Clary
13:30 - 14:00 A409 ID: 660	Small pieces of rocks, shells, sand grains and mineral nodules: islands and ocean as geological strategic projects in Brazil	Maria Margaret Lopes
14:00 - 14:30 A410 ID: 812	Scale in the history of geology	Martina Kölbl-Ebert
14:30 - 15:00 A411 ID: 893	Caught between cosmos and crystals, space and time: John Herschel's planet Earth	Gregory Good

Wednesday, July 28, 2021 13:00 – 15:00

Virtual Hall 10		
Symposium (2/2) Women and academic careers in Central and Eastern Europe after the 2nd World War (1945–1968). S held in honor of S. Štrbáňová (Com on Wom and Gender in Scie, Tech and Med) - ID 18 Symposium organizer: Adéla Jůnová Macková, Željko Oset Chair: Adéla Jůnová Macková		
13:00 - 13:30 A412 ID: 481	Microbiologist Jindra Málková (1914-1954) between family, science and ideology.	Martin Franc

Virtual Hall 10		
13:30 - 14:00 A413 ID: 30	Could a woman become a professor of mathematics in a communist – ruled Poland?	Danuta Ciesielska
14:00 - 14:15 A414 ID: 1333	Soňa	Milada Sekyrkova
14:15 - 14:45 A415 ID: 1322	Reminiscences and recollections of an "amateur" historian of science	Soňa Štrbáňová
14:45 - 15:00 A416 ID: 1334	Video	Petr Svobodný

Wednesday, July 28, 2021 13:00 – 15:00

Virtual Hall 11		
Symposium (6/7) 16th Annual Symposium of the Social History of Military Technology (ICOHTEC) - ID 129 Symposium organizer: Barton C. Hacker, Ciro Paoletti		
13:00 - 13:30 A417 ID: 336	Does the military need history?	Matitiahu Mayzel
13:30 - 14:00 A418 ID: 877	On civil service: reusing military assets for civilian purposes in Italy 1945-1955	Ciro Paoletti
14:00 - 14:30 A419 ID: 900	Warfare in the Cyber Age - Blurred Boundaries, New Trajectories for Conflict and Competition, and the Growing Cyber Role of the Private Sector in National Defense	Christopher Weimar

Wednesday, July 28, 2021 13:00 – 15:00

Virtual Hall 12
Symposium (Part 1/2) Scientific Instruments and Literature (Commission on Science and Literature) - ID 286 Symposium organizer: George N. Vlahakis, Janet Laidla

Virtual Hall 12		
Chair: Sara Schechner		
13:00 - 13:30 A420 ID: 682	Tell-tale instruments in Herman Melville's Moby-Dick	Sara J. Schechner
13:30 - 14:00 A421 ID: 802	Magic instruments in literature	Convin Splettsen

Wednesday, July 28, 2021 15:30 – 17:30

Virtual Hall 1		
The gender gap in science, and in the history of science and technology: historical perspective and IUHPST/DHST policies (Com. on Women and Gender in Science, Technology and Medicine) - ID 98 Symposium organizer: Catherine Jami, Maria Rentetzi Chair: Angela Creager		
15:30 - 16:00 A422 ID: 182	Gender differences in the Global Survey of Scientists	Rachel Ivie
16:00 - 16:30 A423 ID: 233	Effects of gender on academic publishing in mathematics and physics	Helena Mihaljević
16:30 - 17:00 A424 ID: 172	History, One of Many Tools Towards New Practices for Gender Equality in the History of Science	Isabelle Lémonon Waxin
17:00 - 17:30 A425 ID: 181	Victorian women in the natural sciences: Historical perspectives for current Gender Gap work	Don Opitz

Wednesday, July 28, 2021 18:00 – 20:45

Virtual Hall 1
General Assembly

Thursday, July 29, 2021 10:00 – 12:00

Virtual Hall 1

Symposium (Part 2/4) Mathematical proofs and styles of reasoning: East vs. West - ID 55

Symposium organizer: Jens Lemanski, Ioannis Vandoulakis, Eberhard Knobloch
Chair: Eberhard Knobloch

10:00 - 10:30 A426 ID: 89	Did Lobachevsky have a model of his "imaginary geometry"?	Andrei Rodin
10:30 - 11:00 A427 ID: 96	Proof-events and agency: a new approach to the history of proving	Ioannis Vandoulakis
11:00 - 11:30 A428 ID: 136	Diagrammatic proofs in the east and west	Jens Lemanski
11:30 - 12:00 A429 ID: 1294	António Monteiro and his influence on Brazilian and Argentinian Mathematics (1945-1980)	Luis Saraiva

Thursday, July 29, 2021 10:00 – 12:00

Virtual Hall 2

Symposium (Part 1/3) Meteorological and magnetic observatories in the 19th century - ID 276

Symposium organizer: Fernando B. Figueiredo, Josep Batló
Chair: Fernando B. Figueiredo

10:00 - 10:30 A430 ID: 569	North and south: knowledge exchange between the magnetic and meteorological observatories of Greenwich and the Cape, 1841 to 1910	Louise Devoy
10:30 - 11:00 A431 ID: 678	Kew observatory in europe and beyond, 1850-1900	Lee Macdonald
11:00 - 11:30 A432 ID: 752	Astronomical labourers and the self-registering instruments of the Magnetic and Meteorological Department of the Royal Observatory at Greenwich 1838-1881	Daniel Belteki

Thursday, July 29, 2021 10:00 – 12:00

Virtual Hall 3

Symposium (Part 3/5) Computing in the sciences and in technology. An Aristotelian perspective (HaPoC) - ID 13

Symposium organizer: Arianna Borrelli, Liesbeth De Mol

Chair: Maarten Bullynck

10:00 - 10:30 A433 ID: 42	Computers in the service of Ekistics: On the science of human settlement in the post-war period	Nathalie Bredella
10:30 - 11:00 A434 ID: 137	How computers helped to build Czechoslovak dams in the 1950	Helena Durnova
11:00 - 11:30 A435 ID: 180	Theoretical and practical objectives of early machine translation in the 1960s	Jacqueline LEON
11:30 - 12:00 A436 ID: 332	The telos of confrontation: The place of ideology in history and historiography of Cold War computing	Ksenia Tatarchenko

Thursday, July 29, 2021 10:00 – 12:00

Virtual Hall 4

Symposium (Part 2/2) Politics, Protest and Big Technology (ICOHTEC) - ID 565

Symposium organizer: Susan Schmidt-Horning

Chair: Antoni Roca Rosell

10:00 - 10:30 A437 ID: 640	Lewis Mumford on science, technology and power	Peeter Müürsepp

Thursday, July 29, 2021 10:00 – 12:00

Virtual Hall 5

Symposium (Part 1/3) History of technology and museum business in XXI century. New actors, new networks, new and old issues - ID 558

Symposium organizer: Roman Artemenko, Piotr W. Fuglewicz

Virtual Hall 5		
10:00 - 10:10 A438 ID: 868	E-POSTER Museum or "shelter for old machines"? The case of private local museums	Anna V. Samokish
10:10 - 10:20 A439 ID: 896	E-POSTER Making the way to post-industrial museum	Roman V. Artemenko
10:20 - 10:30 A440 ID: 924	E-POSTER Connected computer brands - how big brands connected unknowingly with each other	Bart van den Akker
10:30 - 10:40 A441 ID: 933	E-POSTER Computer museum as ICT technology archive	Rihards Balodis

Thursday, July 29, 2021 10:00 – 12:00

Virtual Hall 6		
Symposium Popular Representation/Misrepresentation of Modern Physical Theories (Commission on the History of Physics) - ID 225 Symposium organizer: Jaume Navarro		
10:00 - 10:30 A442 ID: 1291	Whittaker, Einstein and the History of the Ether. Alternative interpretation, blunder or bigotry?	Jaume Navarro
10:30 - 11:00 A443 ID: 274	Causation and morality: Herbert Samuel and Arthur Eddington about Heisenberg's principle	Florian LAGUENS
11:00 - 11:30 A444 ID: 1185	Goethe ab omni naevo vindicatus (fere): 20th-century physicists reread Goethe vs. Newton	Rocco Gaudenzi
11:30 - 12:00 A445 ID: 1313	When space-time met the world revolution	Alexei Kojevnikov

Thursday, July 29, 2021 10:00 – 12:00

Virtual Hall 7

Virtual Hall 7		
Symposium (Part 1/2) Knowledge Cultures of the In-Between (Europe/East Asia): Mixtures, Communications and Ruptures in Material Cultures of Knowledge - ID 340 Symposium organizer: Bettina Wahrig, Shao-Li Lu Chair: Angelika Messner		
10:00 - 10:30 A446 ID: 570	Using female body drugs for healings and longevity in Late Ming China	Hsiu-fen Chen
10:30 - 11:00 A447 ID: 725	Women's medicine in premodern Europe (2): Conceptions of birth, hands, time and the world: from premodern to modern obstetrics	Bettina Wahrig
11:00 - 11:30 A448 ID: 699	Eumenol—merck's patent emmenagogue and its chinese contexts (1896-1961)	JEN-DER LEE Chih-Hung Chen
11:30 - 12:00 A449 ID: 766	Translation, Production and Application: Western Medicine at the Early Qing Court	Shih-Hsun Liu

Thursday, July 29, 2021 10:00 – 12:00

Virtual Hall 8		
Session XIV - From Late Barock Time towards Enlightenment Chair: Marek Ďurčanský		
10:00 - 10:30 A450 ID: 1153	Conflict and Controversy in the University of Halle: Social Control and the Early Sciences in Germany, c. 1694-1730	Ellen McLinden
10:30 - 11:00 A451 ID: 1031	The idea of "science" in eighteenth-century England.	Luiz Carlos Soares

Thursday, July 29, 2021 10:00 – 12:00

Virtual Hall 9		
Symposium (Part 1/3) Professional lineages and the pursuit of astronomy in medieval and early modern India (CHAMA) - ID 175		

Virtual Hall 9		
Symposium organizer: Clemency Montelle, K. Ramasubramanian Chair: Aditya Kolachana		
10:00 - 10:30 A452 ID: 399	The Parvadvayasādhana of Mallāri: A Sanskrit table text to compute eclipses	K Ramasubramanian
10:30 - 11:00 A453 ID: 321	Gaṇeśapakṣa: the Grahalāghava of Gaṇeśa Daivajña and its commentaries by Mallāri and Viśvanātha	Sahana Cidambi
11:00 - 11:30 A454 ID: 414	From complements to critiques: the culture of astronomy in Kāśī of the seventeenth century	Anuj Misra
11:30 - 12:00 A455 ID: 333	The Gūḍhārthaprakāśikā of Raṅganātha and its significance	Dinesh Mohan Joshi

Thursday, July 29, 2021 10:00 – 12:00

Virtual Hall 10		
Session XV (Part 1/2) - Chemistry Chair: Jiří Šoukal		
10:00 - 10:30 A456 ID: 1119	Philip II and the hispanic early modern empire: alchemy and natural history at Potosi	Mariana Sánchez
10:30 - 11:00 A457 ID: 1091	Iatrochemistry movement at ottomans	ilknur şahin
11:00 - 11:30 A458 ID: 1169	The tantalum metals and the attribution of elementary status in nineteenth-century analytical chemistry	Sarah Hijmans

Thursday, July 29, 2021 10:00 – 12:00

Virtual Hall 11
Symposium (Part 4/6) Transportation History: Canals and goals of civil engineering (ICOHTEC) - ID 526

Virtual Hall 11		
Symposium organizer: Timo Myllyntaus, Hugo Pereira Chair: Timo Myllyntaus		
10:00 - 10:30 A459 ID: 788	Navigation canals in Spain. Territorial and ideological impact of a utopia	Daniel Crespo
10:30 - 11:00 A460 ID: 762	The Industrial Canals: From Transport Routes to Leisure, Cultural and Environmental Corridors. Regent´s Canal, London	Beatriz Cabau
11:00 - 11:30 A461 ID: 841	The British vs. the French: Rival Traditions in the Planning of American Canals and Railroads, 1800 to 1869	Todd Shallat
11:30 - 12:00 A462 ID: 712	Technological continuation and innovation: three super combined bridge of the Qiantang River and the Yangtze River, 1935-1969	Lie SUN

Thursday, July 29, 2021 10:00 – 12:00

Virtual Hall 12		
Session XVI (Part 1/5) - Medicine Chair: Karel Černý		
10:00 - 10:30 A463 ID: 1177	Avicenna's Cardiac Drugs transmitted: an examination of Quṭb al-Dīn Shīrāzī's commentary on Avicenna's Canon of Medicine	Akihiro Tawara
10:30 - 11:00 A464 ID: 1099	The scientific subject in the middle ages: eyeglasses, scribes, and ways of seeing	Paula Nunez de Villavicencio
11:00 - 11:30 A465 ID: 1111	Bungler or Pioneer: Did Johann Dryander Forestall Vesalius in Brain Anatomy?	Lilla Vekerdy
11:30 - 12:00 A466 ID: 1181	Maurício Oscar da Rocha e Silva: pharmaceutical research and its institutionalization in São Paulo – Brazil (1934 - 1942)	Isabella Bonaventura

Thursday, July 29, 2021 10:00 – 12:00

Virtual Hall 13

Session XVII (Part 1/2) - Science and Philosophy

Chair: Lenka Ovčáčková

10:00 - 10:30 A467 ID: 1088	The asymmetric model of the relation between the history of science and the philosophy of science	Alexander Fursov
10:30 - 11:00 A468 ID: 1172	Issues of evaluating the significance of Late Medieval Natural philosophy	Julita Slipkauskaitė
11:00 - 11:30 A469 ID: 1093	Collaboration of Polish Logicians with Heinrich Scholz and "Group from Münster" (1932-1956)	Gabriela Besler

Thursday, July 29, 2021 13:00 – 15:00

Virtual Hall 1

Symposium Assistive technologies, (dis)ability studies, and public health (ICOHTEC) - ID 200

Symposium organizer: Susan Schmidt Horning, Ewelina Twardoch-Ras

Chair: Jaroslav Švelch

13:00 - 13:30 A470 ID: 258	From fluorescent gloves to closed-captioning. The deaf American's struggle for civil rights	Magdalena Zdrodowska
13:30 - 14:00 A471 ID: 789	"Circumventive organs" and artificial tissues' designs. Around the inside-body prosthesis in bioartistic projects	Ewelina Twardoch-Raś
14:00 - 14:30 A472 ID: 958	When health became wealth: the Progressive Era and the economic foundations of public health in the United State	Michael Halpern

Thursday, July 29, 2021 13:00 – 15:00

Virtual Hall 2

Symposium (Part 2/3) Meteorological and magnetic observatories in the 19th century - ID 278

Virtual Hall 2		
Symposium organizer: Fernando Figueiredo, Josep Batló Chair: Josep Batló		
13:00 - 13:30 A473 ID: 459	The Toronto Magnetic Observatory as an initiator of scientific work in Canada	Peter Broughton
13:30 - 14:00 A474 ID: 647	The visit of emperor of Brazil, Pedro ii, in 1872 to the meteorological and magnetic coimbra observatory: contributions to an archaeology of a scientific space	Fernando B. Figueiredo
14:00 - 14:30 A475 ID: 738	Historical geomagnetic observations from Prague Observatory (1839 – 1917) and their contribution to geomagnetic research	Pavel Hejda
14:30 - 15:00 A476 ID: 880	The first instruments of the Meteorological and Magnetic Observatory of Coimbra: the standard barometer of Welsh	Paulo Ribeiro

Thursday, July 29, 2021 13:00 – 15:00

Virtual Hall 3		
Symposium IUHPST essay prize lecture and presentation (DLMPST Joint Commission (JC)) - ID 315 Chair: Hasok Chang		
13:00 - 15:00 A477 ID: 1326	Misinformation age: What early modern scientific fakes can tell us about today's online fabrications	Marlis Hinckley

Thursday, July 29, 2021 13:00 – 15:00

Virtual Hall 4		
Symposium The History of Artificial Intelligence (AI) and Robotics in Germany (ICOHTEC) - ID 1318 Symposium organizer: Frank Dittmann, Stefan Poser		
13:00 - 13:30 A478 ID: 1319	Histories of Artificial Intelligence (AI) in Germany	Rudolf Seising Helen Piel
13:30 - 14:00 A479	From Syntelman to Rotex – or the birth of autonomy	Frank Dittmann

Virtual Hall 4		
ID: 1321		
14:00 - 14:30 A480 ID: 1323	Comment on the Symposium's Papers by Stefan Poser and Discussion on Robots and AI	Frank Dittmann

Thursday, July 29, 2021 13:00 – 15:00

Virtual Hall 5		
Symposium (Part 2/3) History of technology and museum business in XXI century. Information technology and computer science: heritage issues - ID 845 Symposium organizer: Roman V. Artemenko, Piotr W. Fuglewicz		
13:00 - 13:15 A481 ID: 955	E-POSTER How myths are born: John V. Atanasoff, Mikhail Kravchuk, and Sergey Lebedev	Valery V. Shilov
13:15 - 13:30 A482 ID: 956	E-POSTER Timeline excerpts from the history of the Szeged IT collection	Mihály Bohus
13:30 - 13:45 A483 ID: 957	E-POSTER Andromorphism in the language of computers: a short history	Chris Zielinski

Thursday, July 29, 2021 13:00 – 15:00

Virtual Hall 6		
Session XIX (Part 1/4) - History of Physics Chair: Petra Hyklová		
13:00 - 13:30 A484 ID: 1008	Estevao Cabral versus Isaac Newton: a Portuguese critique on Newtonian theories of light and colors	Breno Arsioli Moura
13:30 - 14:00 A485 ID: 1143	Accuracy and error in Lord Rayleigh's teamwork	Vasiliki Christopoulou
14:00 - 14:30 A486	Planck's constant in retrospect	Henk Kubbinga

Virtual Hall 6		
ID: 1058		
14:30 - 15:00 A487 ID: 1075	Photography as a scientific tool in the study and medical illustration of the bubonic plague in Portugal (1899-1909)	Maria Estela Jardim

Thursday, July 29, 2021 13:00 – 15:00

Virtual Hall 7		
Symposium (Part 2/2) Knowledge Cultures of the In-Between (Europe/East Asia): Mixtures, Communications and Ruptures in Material Cultures of Knowledge - ID 471 Symposium organizer: Hsiu-fen Chen, Angelika Messner Chair: Hsiu-fen Chen		
13:00 - 13:30 A488 ID: 578	Therapeutic Trials of Prophylactic Alkaloids in British Malaya	Jiun Shen FONG
13:30 - 14:00 A489 ID: 579	Coca and cinchona: enacting the material relation in/between Taiwan and the globe	Shao-li Lu
14:00 - 14:30 A490 ID: 687	Medicalisation and its dependency on miracles and ruptures: Materialisations of drugs in South China (ca. 1870-1920)	Dominik Merdes
14:30 - 15:00 A491 ID: 1311	General discussion of Panels 471 and 340	Bettina Wahrig

Thursday, July 29, 2021 13:00 – 15:00

Virtual Hall 8		
Symposium (Part 8/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 213 Chair: Janet Laidla Symposium organizer: Janet Laidla		
13:00 - 13:30 A492 ID: 767	The catalogue of Lavoisier's collection: new light on an important 18th century collection of scientific instruments.	Paolo Brenni

Virtual Hall 8		
13:30 - 14:00 A493 ID: 283	Horace-Bénédict de Saussure (1744-1799): a pioneer of alpine measurement	Fischer Stéphane
14:00 - 14:30 A494 ID: 1095	Ultramicroscopy in solid and liquid media – optical equipment to study nanoparticles prior to 1920	Timo Mappes

Thursday, July 29, 2021 13:00 – 15:00

Virtual Hall 9		
Symposium (Part 2/3) Professional lineages and the pursuit of astronomy in medieval and early modern India 2/3 (CHAMA) - ID 176 Symposium organizer: Clemency Montelle, K. Ramasubramanian Chair: Anuj Misra		
13:00 - 13:30 A495 ID: 387	Some traditional astronomical teachings from Lalla to Bhāskarācārya through Śrīpati	Jambugahapitiye Dhammaloka
13:30 - 14:00 A496 ID: 402	Remarkable contributions of Muniśvara: Dadhigrāma's tail end astronomer	Mahesh K
14:00 - 14:30 A497 ID: 426	Mathematical-Astronomical works by Luṭfullāh and Khairullāh, son and grandson of Aḥmad Ma'mār, the architect of Taj Mahal	S M Razaullah Ansari
14:30 - 15:00 A498 ID: 514	The use of continued fraction technique among the works of Kerala astronomers	Venketeswara Pai R.

Thursday, July 29, 2021 13:00 – 15:00

Virtual Hall 10		
Session XV (Part 2/2) - Chemistry Chair: Jiří Šoukal		
13:00 - 13:30 A499 ID: 1056	Russian colloid chemist Weymarn's activity in Japan in 1920s	Takako Honjo

Virtual Hall 10		
13:30 - 14:00 A500 ID: 1262	The Chemical Agent Monitor: UK-US technological collaboration in the 1980s	Abigail Eiceman
14:00 - 14:30 A501 ID: 1151	Hierarchies of models: creating a normative framework for computational quantum chemistry	Stylianos Kampouridis
14:30 - 15:00 A502 ID: 1205	The politicisation of hydroxychloroquine during sars cov-2 pandemic- making a giant of a dwarf	Kamna Tiwary

Thursday, July 29, 2021 13:00 – 15:00

Virtual Hall 11		
Symposium (Part 1/2) Transnational entanglements in Cold War social science – ID 359 Symposium organizer: Christian Dayé, Verena Lehmbrock Chair: Christian Dayé		
13:00 - 13:30 A503 ID: 419	Cold War social sciences: Transnational entanglements	Mark Solovey
13:30 - 14:00 A504 ID: 513	Catastrophes, cross-cultural studies, and Cold War: The transnationalism of US-American "social science disaster research"	Cécile Stehrenberger
14:00 - 14:30 A505 ID: 777	From Industrial Sociology to Social Planning: Sociology and Welfare Policies in Late Socialism, Czechoslovakia 1968-1989	Vítězslav Sommer
14:30 - 15:00 A506 ID: 827	Paying attention to each other's feelings. East German management training and the transnational geneaology of its psychological techniques	Verena Lehmbrock

Thursday, July 29, 2021 13:00 – 15:00

Virtual Hall 12
Session XVI (Part 2/5) - Medicine Chair: Tereza Kopecká

Virtual Hall 12		
13:00 - 13:30 A507 ID: 1236	Rough on rats: pesticides and suicides in the age of empire	Peter Soppelsa
13:30 - 14:00 A508 ID: 1083	Ukrainian researchers of the spanish flu pandemic in 1918-1920	Olena Vasylieva
14:00 - 14:30 A509 ID: 1087	Science, history and ethic: the anthropological anti-racist discourse of Juan Comas in Mexico.	Miguel García Murcia
14:30 - 15:00 A510 ID: 1090	The Relationship between People's Beliefs and Medical Activities in Hubei in Late Imperial China	Lu Cheng

Thursday, July 29, 2021 13:00 – 15:00

Virtual Hall 13		
Session XVIII (Part 1/2) - Mathematics Chair: Alena Šolcová		
13:00 - 13:20 A511 ID: 1167	Different languages of number: a comparative study of the numerical mysticism of Early Pythagoreanism and Book of Changes(Chou i)	Yimeng Wang
13:20 - 13:40 A512 ID: 1200	The Recension of the Conics of Apollonius by Naṣīr al-Dīn al-Ṭūsī	Zeinab Karimian
13:40 - 14:00 A513 ID: 1108	New Insights into the Medieval Arabic Transmission of Euclid's Elements	Gregg De Young
14:00 - 14:20 A514 ID: 1062	"Arte giamata arismetica et cum altre cose insema": abbacus manuscripts in 15th-century Lombardy	Nadia Ambrosetti
14:20 - 14:40 A515 ID: 1076	Tratado de la fábrica y uso de las pantómetras (Anonymous, 17th c.)	Elena Ausejo

Thursday, July 29, 2021 15:30 – 17:30

Virtual Hall 1

Symposium_Migration, transportation, mobility and displacement (ICOHTEC) - ID 158

Symposium organizer: Susan Schmidt-Horning, Jan Musekamp

15:30 - 16:00 A516 ID: 201	Displaced cities: interiority and identity in refugee camp	Rana Abudayyeh
16:30 - 17:00 A517 ID: 241	Racist Borders: Technology, Pseudo-Science and Migration Policies in late 19th Century Germany, Russian Empire, Canada, and Brazil	Jan Musekamp
17:00 - 17:30 A518 ID: 382	Mobile Jobs, Mobile Worksites in the Tennessee Valley Authority (TVA), 1931-1945.	Tracy Walker Moir-McClean

Thursday, July 29, 2021 15:30 – 17:30

Virtual Hall 2

Symp (Part 4/4) The materiality of knowledge circulation between China and Europe: physical formats, epistemic genres, spatial localities (16th-18th century) (ISHEASTM) - ID 34

Symposium organizer: Huiyi Wu, Marta Hanson

Chair: Catherine Jami

15:30 - 16:00 A519 ID: 194	Little tools of Sinographic knowledge	Florence Hsia
16:00 - 16:30 A520 ID: 568	Michael Boym SJ (1612-1659) and the publication of Flora Sinensis (Vienna, 1656) as part of the Jesuit enterprise	Eszter Csillag
16:30 - 17:00 A521 ID: 50	Georg Joseph Kamel SJ (1661–1706): Natural knowledge in transit between the Philippines and Europe	Sebestian Kroupa
17:00 - 17:30 A522 ID: 727	The Golden Mirror of Flowing Waters and the Global Mapping of Waterways	Alexander Statman

Thursday, July 29, 2021 15:30 – 17:30

Virtual Hall 3

Symposium (Part 4/5) Computing in the sciences and in technology. An Aristotelian perspective (HaPoC) - ID 14

Symposium organizer: Arianna Borrelli, Liesbeth De Mol

Chair: Liesbeth De Mol

15:30 - 16:00 A523 ID: 48	How Lew Kowarski brought computing to CERN	Arianna Borrelli
16:00 - 16:30 A524 ID: 771	The principle of the division of labor in computing practices (1940s-1950s): presuppositions, advances, biases	Marie-José Durand-Richard
16:30 - 17:00 A525 ID: 236	"Coded conduct: making users and the automation of mathematics"	Stephanie Dick

Thursday, July 29, 2021 15:30 – 17:30

Virtual Hall 4

Symposium (Part 4/5) Re-scaling & de-centering the history of oceanography: the 'hidden figures' and hidden dimensions of global ocean science (ICHO) - ID 455

Symposium organizer: Penelope Hardy

-- Choose --: Cornelia Lüdecke

Chair: Penelope Hardy

15:30 - 16:00 A526 ID: 636	Giants of the deep: Scientific and cultural encounters with polar gigantism in Antarctica	Joy McCann
16:00 - 16:30 A527 ID: 969	Science in a Sub: the inter-war expeditions of Vening Meinesz	Katharine Anderson
16:30 - 17:00 A528 ID: 610	Canada's underwater habitat program and vertical dimensions of marine sovereignty	Antony Adler

Thursday, July 29, 2021 15:30 – 17:30

Virtual Hall 5

Symposium (Part 3/3) History of technology and museum business in XXI century. Information technology and computer science: heritage issues - ID 846

Symposium organizer: Roman V. Artemenko, Piotr W. Fuglewicz

15:30 - 15:45 A529 ID: 951	E-POSTER Eastern European computers in the 60s and 70s: independent design, licensing, and cloning	Tomasz Kulisiewicz
15:45 - 16:00 A530 ID: 950	E-POSTER Iskra Delta project "Milijarda" (en.: Billion) – Yugoslavs setting up an internet network in China in 1984	Gaja Zornada
16:00 - 16:15 A531 ID: 952	E-POSTER The origins of computer industry in Slovakia	Martin Šperka

Thursday, July 29, 2021 15:30 – 17:30

Virtual Hall 6

Symposium Tradition, innovation, and emerging technologies (ICOHTEC) - ID 240

Symposium organizer: Susan Schmidt-Horning, Jaroslav Švelch
Chair: Florian Bettel

15:30 - 16:00 A532 ID: 920	Creative Construction: The Integral Importance of Froth, Fraud and Fear in Emerging Technologies	Jonathan Coopersmith
16:00 - 16:30 A533 ID: 820	Metering power: thieves and innovation in electric Mexico City, 1900-1918.	Diana Montano
16:30 - 17:00 A534 ID: 404	"Like dwarves perched on the shoulders of giants". Tradition and innovation in salt extraction technologies: the case of Tuscany (centuries 15th BC-21st AD)	Valentina Limina

Thursday, July 29, 2021 15:30 – 17:30

Virtual Hall 7

Symposium Neighborhood relations: Revisiting the history of biochemistry and its neighbors in the first

Virtual Hall 7		
half of the twentieth century - ID 193 Symposium organizer: Gina Surita, Caterina Schürch, Gina Surita		
15:30 - 16:00 A535 ID: 260	Biochemistry — characterized by its linking capacities	Caterina Schürch
16:00 - 16:30 A536 ID: 232	"Tymonucleic acid was not as respectable as our DNA": Jean Brachet's research on nucleic acid metabolism (1929-1945)	Alessandra Passariello
16:30 - 17:00 A537 ID: 487	Commentary: Of biochemical communities, identity-forming alliances, and Otto Warburg's poaching in foreign disciplinary territories	Kärin Nickelsen

Thursday, July 29, 2021 15:30 – 17:30

Virtual Hall 8
Symposium (Part 9/14) Scientific Instrument Commission - Annual General Meeting (SIC)

Thursday, July 29, 2021 15:30 – 17:30

Virtual Hall 9		
Symposium (Part 3/3) Professional lineages and the pursuit of astronomy in medieval and early modern India (CHAMA) - ID 177 Symposium organizer: Clemency Montelle, K. Ramasubramanian Chair: Venketesvara Pai		
15:30 - 16:00 A538 ID: 282	Mādhava's Lagnaprakaraṇa and its influence on the Kerala school	Aditya Kolachana
16:00 - 16:30 A539 ID: 337	Mathematics embedded in the nṛttaṃ and saṇgītaṃ traditions of India	Sruthi Natanakumar
16:30 - 17:00 A540 ID: 380	Investigations on eclipse data preserved in the Kerala tradition	D.G. Sooryanarayan

Thursday, July 29, 2021 15:30 – 17:30

Virtual Hall 10

Symposium Other than the Population Council: A Trans-Asian History of Science and the Population Problem in East Asia - ID 45

Symposium organizer: Aya Homei, Jaehwan Hyun

Chair: Aya Homei

15:30 - 16:00 A541 ID: 93	Imperial Geography of Population: Population at the Intersection of Empire, Nation, and Race in 1910's Korea	Jin-kyung Park
16:00 - 16:30 A542 ID: 561	"Fertile Womb Battalion": The Politics of Motherhood in the Japanese Wartime Population Policy	Sujin Lee
16:30 - 17:00 A543 ID: 525	Belated eugenics? "Feeble-minded" children and the emergence of medical genetics in South Korea	Jaehwan Hyun
17:00 - 17:30 A544 ID: 434	Technoscience and Fertility Governance in Taiwan's Family Planning Programs, 1960s-1970s	Yu-Ling Huang

Thursday, July 29, 2021 15:30 – 17:30

Virtual Hall 11

Symposium (Part 2/2) Transnational entanglements in Cold War social science – ID 368

Symposium organizer: Mark Solovey, Vítězslav Sommer

Chair: Vítězslav Sommer

15:30 - 16:00 A545 ID: 780	Decentering Cold War Social Science: Alva Myrdal's Social Scientific Internationalism at UNESCO, 1950-1955	Per Wisselgren
16:00 - 16:30 A546 ID: 588	'Knowledge Societies' in the Cold War: When 'knowledge' and social science expertise became highly controversial (1940-1980)	Markus Arnold
16:30 - 17:00 A547 ID: 855	'Algorithmic thinking' as a Soviet reinvention of Western theories: cognitive psychology in the USSR in the 1960s -- 1970s.	Ekaterina Babintseva

Thursday, July 29, 2021 15:30 – 17:30

Virtual Hall 12

Symposium (Part 1/2) The shaping of differences in the historiography of ancient mathematics - Editing and translating ancient mathematical texts (IASCUD) - ID 543

Symposium organizer: Karine Chemla, Erwin Neuenschwander

Chair: Erwin Neuenschwander

15:30 - 16:00 A548 ID: 659	Authority and Authenticity. Editing ancient mathematics in Restoration Oxford	Philip Beeley
16:00 - 16:30 A549 ID: 730	J. –L. Lagrange and the translation and diffusion of the greek texts	Xiaofei Wang
16:30 - 17:00 A550 ID: 804	Using European Algebra to Interpret Chinese Traditional Mathematics: The Role of Mei Juecheng (1681-1764) in the Development of Evidential Studies	Qi Han
17:00 - 17:30 A551 ID: 1324	Mathematics and Evidential Scholarship in Eighteenth Century China	Yiwen Zhu

Thursday, July 29, 2021 15:30 – 17:30

Virtual Hall 13

Session XVIII (Part 2/2) - Mathematics

Chair: Alena Šolcová

15:30 - 16:00 A552 ID: 1195	The axiomatization of arithmetic: from Grassmann to Peano	Michel Salazar
16:00 - 16:30 A553 ID: 1112	'As a experienced missionary would explain the gospel to cannibals': Terracini and Levi in Argentina (1938-1948)	Erika Luciano
16:30 - 17:00 A554 ID: 1059	Numbers matter – Identity formation, scientific boundaries and community building in applied mechanics and applied mathematics in Denmark	Laila Zwisler
17:00 - 17:30 A555	On the meaning of mathematical patrimony: the case-study of Gino Fano’s personal collection	Elena Scalambro

Virtual Hall 13		
ID: 1084		

Thursday, July 29, 2021 18:00 – 20:00

Virtual Hall 1		
Symposium Medical technologies (ICOHTEC) - ID 239 Symposium organizer: Susan Schmidt-Horning, Fanxiang Min Chair: Yuping Zhou		
18:00 - 18:30 A556 ID: 515	Technology and Space——An Evolutionary History of the Operation Room: How did Medical Ideas and Technologies Shape and Reshape Surgical Space?	Fanxiang MIN
18:30 - 19:00 A557 ID: 694	Urban life, medicine market and medical school: regional medical society of Hangzhou from the 16th to 18th centuries	Yurong Feng

Thursday, July 29, 2021 18:00 – 20:00

Virtual Hall 2		
Symposium (Part 3/3) Meteorological and magnetic observatories in the 19th century - ID 279 Symposium organizer: Fernando B. Figueiredo, Josep Batló Chair: Louise Devoy		
18:00 - 18:30 A558 ID: 592	The creation of the Austrian I.R. Central Institute of Meteorology and Earthmagnetism (ZAMG) in 1851	Christa Hammerl
18:30 - 19:00 A559 ID: 743	Fail at home, success abroad. The case of the Spanish geomagnetic observatories in the XIX century	Josep Batlló
19:00 - 19:30 A560 ID: 779	History of space weather studies and observations: Russian aspect	Anatoly Soloviev
19:30 - 20:00 A561 ID: 818	Algiers 1841: French colony to serve the Magnetic crusade?	Frederic Soulu

Thursday, July 29, 2021 18:00 – 20:00

Virtual Hall 3

Symposium (Part 5/5) Computing in the sciences and in technology. An Aristotelian perspective (HaPoC) - ID 15

Symposium organizer: Arianna Borrelli, Liesbeth De Mol

Chair: Troy Astarte

18:00 - 18:30 A562 ID: 75	What's in a name? Origins, transpositions and transformations of the triptych Algorithm – Code – Program	Liesbeth De Mol
18:30 - 19:00 A563 ID: 257	A multiperspective causal analysis of computing in predictive models based on machine learning	Franck Varenne
19:00 - 19:30 A564 ID: 901	Finding a story for the history of computing	Thomas Haigh
19:30 - 20:00 A565 ID: 277	Roundtable: Promoting dialogue in the history of computing – an Aristotelean perspective	Daniela Zetti

Thursday, July 29, 2021 18:00 – 20:00

Virtual Hall 4

Symposium (Part 5/5) Re-scaling & de-centering the history of oceanography: the 'hidden figures' and hidden dimensions of global ocean science (ICHO) - ID 836

Symposium organizer: Penelope K. Hardy, Cornelia Lüdecke

Chair: Helen Rozwadowski

18:00 - 18:30 A566 ID: 980	Secrecy and Sea-floor spreading: Rethinking the role of Navy oceanography in the development of plate tectonics	Naomi Oreskes
18:30 - 19:00 A567 ID: 977	An 'open secret': Geologists and oil industry secrecy in the Mediterranean's seafloor exploration	Beatriz Martínez-Rius
19:00 - 19:30 A568 ID: 983	Secrecy and seabed mining: questioning the freedom of marine science during the 1970s	Sam Robinson

Virtual Hall 4		
19:30 - 20:00 A569 ID: 1295	The Invisible Sinking Surface: Hydrogeology, Fieldwork and Photography in California	Rina C. Faletti

Thursday, July 29, 2021 18:00 – 20:00

Virtual Hall 5		
Symposium (Part 1/2) Pedagogy beyond giants and dwarfs: using the history of science to enhance education and promote inclusiveness - ID 508 Symposium organizer: Karen A. Rader, Daniel Gamito-Marques Chair: Karen A. Rader, Daniel Gamito-Marques		
18:00 - 18:30 A570 ID: 793	The History of Chemistry in Chemical Education	John Powers
18:30 - 19:00 A571 ID: 781	In praise of a historical storytelling approach in science education	Daniel Gamito-Marques
19:00 - 19:30 A572 ID: 751	Big history in 10-minute videos: How highlights help in survey courses	Allison Marsh
19:30 - 20:00 A573 ID: 763	Bringing history into the lab: a new approach to scientific learning in general education	David Brandon Dennis

Thursday, July 29, 2021 18:00 – 20:00

Virtual Hall 6
CHAMA Meeting

Thursday, July 29, 2021 18:00 – 20:00

Virtual Hall 7
Symposium Artifices in human form: bodies as technology and technologies of the body in early modern and modern China (ICOHTEC) - ID 343

Virtual Hall 7		
Symposium organizer: Mary Augusta Brazelton, Whitney Laemmli Chair: Whitney Laemmli		
18:00 - 18:30 A574 ID: 651	Penicillin and the industrialization of pharmaceutical technologies in China	Mary Brazelton
18:30 - 19:00 A575 ID: 653	Industrial craft: machine, skill, and the making of the factory system	Yuan Yi
19:00 - 19:30 A576 ID: 654	Medical things and the healer's body in the Qing court's Golden Mirror, 1742	Marta Hanson
19:30 - 20:00 A577 ID: 729	Psychology as bodily technology in industrial China	Victor Seow

Thursday, July 29, 2021 18:00 – 20:00

Virtual Hall 8		
Symposium (Part 10/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 215 Symposium organizer: Janet Laidla Chair: Rebekah Higgitt		
18:00 - 18:30 A578 ID: 546	Science, commerce, and art: the evolution and significance of the microscope slide	Alexi Baker
18:30 - 19:00 A579 ID: 873	The IGN instrument Gallery – a collection of threatened instruments	Loïc Jeanson Jean Davoigneau
19:00 - 19:15 A580 ID: 1279	E-POSTER A paper sky - Planispheric celestial volvelles	Thomas Hockey

Thursday, July 29, 2021 18:00 – 20:00

Virtual Hall 9
Symposium (Part 3/3) Evolution of mathematics in China: major figures, anonymous contributors, and

Virtual Hall 9		
the giants among them (ICHM) (with IMU)- ID 70 Symposium organizer: Joseph W. Dauben, Shuchun Guo Brief Introduction: Joseph W. Dauben Chair: Jeff Chen		
18:00 - 18:30 A581 ID: 105	Woodsman and commoner: why did Zhao Shuang and Liu Hui become interested in gou-gu methods?	Zhigang JI
18:30 - 19:00 A582 ID: 117	Liu Hui, Jia Xian, Yang Hui, and two problems in the Nine Chapters on the Art of Mathematics: inscribing squares and circles in given right triangles	Joseph Dauben
19:00 - 19:30 A583 ID: 122	Some examples of how correctly transcribe characters in the 筭數書 Suanshushu	XULIN ZHOU
19:30 - 20:00 A584 ID: 132	Yang Hui's Study of Mathematics in 13th-Century China	Wann-Sheng Horng

Thursday, July 29, 2021 18:00 – 20:00

Virtual Hall 10		
Symposium (Part 1/2) Symposium_Gender and technological systems (ICOHTEC) - ID 121 Symposium organizer: Susan Schmidt-Horning, Peeter Müürsepp Chair: Susan Schmidt-Horning		
18:00 - 18:30 A585 ID: 155	The united states' wireless women of world war I	Alexander Magoun
18:30 - 19:00 A586 ID: 494	"Not spoke for": rearticulating gender, labor, and technology	Khanh Vo
19:00 - 19:30 A587 ID: 695	Al Jolson or Helen Tykociński? A controversy over who was the first to give voice to a film	Sławomir Łotysz

Thursday, July 29, 2021 18:00 – 20:00

Virtual Hall 11

Symposium (Part 5/6) Transportation History: Modern landborne transport solutions: from roads to hubs (ICOHTEC) - ID 530

Symposium organizer: Timo Myllyntaus, Hugo Pereira

Chair: Hugo Pereira

18:00 - 18:30 A588 ID: 718	From the atmospheric railway to Hyperloop: pneumatic transport from the 19th until the 21st century	Laura Meneghello
18:30 - 19:00 A589 ID: 728	Making transportation easier and faster for whom? The emphasis on automobility of post-war traffic engineering and its appropriation in Portugal	M. Luísa Sousa
19:00 - 19:30 A590 ID: 887	Transportation hubs: new public spaces for the city	Patricia Hernández-Lamas Beatriz Cabau

Thursday, July 29, 2021 18:00 – 20:00

Virtual Hall 12

Session XX - Genetics

Chair: Soňa Štrbáňová

18:00 - 18:20 A591 ID: 1103	Neither giants nor dwarves: eugenic family studies and the quest for the "normal" citizen in interwar czechoslovakia	Vojtěch Pojar
18:20 - 18:40 A592 ID: 1201	Mendel Memorial Symposium 1965 – The event of genetics between the past, ideology and its modern development	Simona Slezáková
18:40 - 19:00 A593 ID: 1144	Sketching an "Andean race" through early-twentieth-century scientific diagrams of the "Mongolian spot"	Paloma Rodrigo Gonzales
19:00 - 19:20 A594 ID: 1069	Erotetic Aspects of the History of Classical Genetics	Pablo Lorenzano
19:20 - 19:40 A595	Once upon a time in the Cold War: the construction of molecular genetics of bacteria in Mexico	Marco Ornelas-Cruces

Virtual Hall 12		
ID: 1106		

Thursday, July 29, 2021 18:00 – 20:00

Virtual Hall 13		
Symposium (Part 3/3) CHCMS (History of Chemistry and Molecular Sciences) - ID 1296 Symposium organizer: Brigitte Van Tiggelen Chair: Cyrus Mody		
18:00 - 18:30 A596 ID: 1306	Vanadium: A History of Mexican Chemistry	Rocio Gomez
18:30 - 19:00 A597 ID: 1307	Chemurgy: Agricultural Engineering in Republican China and the American Midwest, 1925-1935	Tristan Revells
19:00 - 19:30 A598 ID: 1308	Chemical information and the history of modern chemistry	Evan Hepler-Smith
19:30 - 20:00 A599 ID: 1310	Comment and general discussion	Brigitte Van Tiggelen

Friday, July 30, 2021 10:00 – 12:00

Virtual Hall 1		
Symposium (Part 1/2) The role of universities in Soviet science - ID 222 Symposium organizer: Sergey Shalimov, Hirofumi Saito Chair: Sergey Shalimov, Hirofumi Saito		
10:00 - 10:20 A600 ID: 296	E-POSTER From initiative to plan. Features of the organization of scientific research in Russian universities of the Imperial and Soviet periods	Mikhail Gribovskiy
10:20 - 10:50 A601 ID: 308	Molecular biology in Soviet universities in the early 1960s	Jérôme PIERREL
10:50 - 11:20	Science studies in the Soviet Union	Viktor Kupriyanov

Virtual Hall 1		
A602 ID: 628		
11:20 - 11:50 A603 ID: 928	The value and the role of the universities in the development of scientific schools and research areas: the experience of Tomsk universities in the 20th century	Alexander Sorokin

Friday, July 30, 2021 10:00 – 12:00

Virtual Hall 2		
Symposium (Part 3/4) Mathematical proofs and styles of reasoning: East vs. West - ID 73 Symposium organizer: Jens Lemanski, Ioannis Vandoulakis, Eberhard Knobloch Chair: Jens Lemanski		
10:00 - 10:30 A604 ID: 230	Mathematical rigour, mathematical creativity, and the transgression of limits	Eberhard Knobloch
10:30 - 11:00 A605 ID: 268	"Proofs as Games?" Frege vs. Hilbert and Wittgenstein	Ingolf Max

Friday, July 30, 2021 10:00 – 12:00

Virtual Hall 3		
Symposium (Part 1/2) Reading the skies: exploring the intersection of ethnometeorology, folk traditions and meteorology (Commission on the History of Meteorology) - ID 416 Symposium organizer: Alexander Hall, Natalija Janc Chair: Alexander Hall		
10:00 - 10:30 A606 ID: 572	Folk meteorology in spanish philippines: Indigenous views on weather, climate, and the environment in the philippines, 16th-19th century	Kerby Alvarez
10:30 - 11:00 A607 ID: 573	Weather and Religion in Europe in the Vulgar Era: the Meteo - providential Saints	Matteo De Vincenzi
11:00 - 11:30 A608	Weather lore and meteorology in the notes of Jan Strialius of Pomnouš (1535/1536-1582)	Barbora Kocánová

Virtual Hall 3		
ID: 619		
11:30 - 12:00 A609 ID: 631	The meteorological knowledge and beliefs in ancient Greece in "Diosemeia" of Aratus	Milan S. Dimitrijević

Friday, July 30, 2021 10:00 – 12:00

Virtual Hall 4		
Symposium (Part 1/5) Art, image, and astronomical knowledge (ICHA/CHAMA) - ID 184 Symposium organizer: Sara J. Schechner, Yunli Shi Chair: Sara J. Schechner		
10:00 - 10:30 A610 ID: 518	What can Neolithic imagery convey about bright stellar transients?	Richard Strom
10:30 - 11:00 A611 ID: 339	The Many Face(t)s of Comets in Early Modernity	Anna Jerratsch
11:00 - 11:30 A612 ID: 553	Mount Taranaki, the great comet of 1882, and the genesis of cometary photography in New Zealand	John Drummond

Friday, July 30, 2021 10:00 – 12:00

Virtual Hall 6		
Symposium (Part 3/3) Science and literature in small and large scales (Commission on Science and Literature) - ID 273 Symposium organizer: George N. Vlahakis Chair: Manolis Kartsonakis		
10:00 - 10:30 A613 ID: 724	The evolution of scientific instruments as a history of intersecting lives: Literature representations of the scientific progress at the 16th century Astronomy	Manolis Kartsonakis
10:30 - 11:00 A614 ID: 759	«Greek Gifted Students' Emotional, Social and Academic Experiences: A Qualitative Analysis»	Anastasia Kyritsi

Virtual Hall 6		
11:00 - 11:30 A615 ID: 1246	The problem of scientific terminology in Lady Welby's significs	Ekaterina Shashlova
11:30 - 12:00 A616 ID: 737	The Doctor - Poet Miltiades Emmanuel (1825-1916), the dengue fever in the city of Smyrna in Asia Minor and a satirical poem	Konstantinos Konstantopoulos

Friday, July 30, 2021 10:00 – 12:00

Virtual Hall 7		
Symposium (Part 1/3) Interactions and interchanges in the history of science, technology, and medicine - ID 151 Symposium organizer: Hugh Richard Slotten, Geoff Bil Chair: Hugh Slotten		
10:00 - 10:30 A617 ID: 390	Symposium Introduction and overview	Hugh Slotten
10:30 - 11:00 A618 ID: 594	Collecting, classifying and constructing nature: indigenous knowledge and the naming of species in the Pacific, 1768–1782	Edwin Rose
11:00 - 11:30 A619 ID: 796	Implementing global health policy: eradicating smallpox in Nepal	Susan Heydon

Friday, July 30, 2021 10:00 – 12:00

Virtual Hall 8		
Symposium Unexpected Technology-Based Games (ICOHTEC) - ID 280 Symposium organizer: Florian Bettel, Jaroslav Švelch Chair: Stefan Poser		
10:00 - 10:30 A620 ID: 937	Tourism – a Kind of Playing? A methodological approach	Stefan Poser
10:30 - 11:00	PlayXR – prototyping multiplayer mixed reality gaming	Georg Hobmeier

Virtual Hall 8		
A621 ID: 584		
11:00 - 11:30 A622 ID: 882	Neuromorphic Games, from Ramon y Cajal to art and play in public experiments with Brain Computer Interfaces	Margarete Jahrmann
11:30 - 12:00 A623 ID: 358	Playgrounds—Topographies of Play and Technology	Florian Bettel

Friday, July 30, 2021 10:00 – 12:00

Virtual Hall 9		
Symposium (Part 1/2) They might be giants: lesser power and alternative channel efforts in science diplomacy (Commission on Science, Technology and Diplomacy) - ID 484 Symposium organizer: Sam Robinson Chair: Rebekah Higgitt, Simone Turchetti		
10:00 - 10:30 A624 ID: 698	Combining History and International Relations to theorize non-state science diplomacy actors: lessons from H2020 InsSciDE	Rasmus Gjedssø Bertelsen
10:30 - 11:00 A625 ID: 783	Competing with giants: the alliance between science and diplomacy for the defense of Portuguese colonial claims in the Congo	Daniel Gamito-Marques
11:00 - 11:30 A626 ID: 962	Instruments in science diplomacy: Seismographs and the Limited Test Ban Treaty	Lif Jacobsen
11:30 - 12:00 A627 ID: 741	A disunited front: china's failure to win support for bacteriological warfare allegations in the world federation of scientific workers	Gordon Barrett

Friday, July 30, 2021 10:00 – 12:00

Virtual Hall 10
Session XVI (Part 3/5) - Medicine Chair: Tereza Kopecká

Virtual Hall 10		
10:00 - 10:30 A628 ID: 1125	A mother's siege: love and knowledge in understanding autism	Marga Vicedo
10:30 - 11:00 A629 ID: 1126	Early experimental-psychological work on deductive reasoning in the light of logical positivism	Niki Pfeifer

Friday, July 30, 2021 10:00 – 12:00

Virtual Hall 11		
Symposium (7/7) 16th Annual Symposium of the Social History of Military Technology (ICOHTEC) - ID 130 Symposium organizer: Barton C. Hacker, Ciro Paoletti		
10:00 - 10:30 A630 ID: 362	An age of crisis in space?: science fiction and the future of space warfare	Heather Venable
10:30 - 11:00 A631 ID: 466	The Social History of the GPS: How Precision Navigation and Timing has Transformed Our Lives	Michaela Schannep

Friday, July 30, 2021 10:00 – 12:00

Virtual Hall 12		
Symposium (Part 2/2) The shaping of differences in the historiography of ancient mathematics - Editing and translating ancient mathematical texts (IASCUD) - ID 547 Symposium organizer: Karine Chemla, Erwin Neuenschwander Chair: Karine Chemla		
10:00 - 10:30 A632 ID: 630	Historiography in the making: Humboldt and the mathematicians on ancient mathematical texts	Ivahn Smadja
10:30 - 11:00 A633 ID: 620	Editing the Rhind Mathematical Papyrus	Christopher Hollings
11:00 - 11:30 A634	Differences between interpretations using and not using modern mathematical symbols? The "procedure	Xiaohan Zhou

Virtual Hall 12		
ID: 825	of pile-accumulation" in the Jade Mirror (1303)	
11:30 - 12:00 A635 ID: 847	Van der Waerden's Approach to History of Science. His methods and results in comparison to contemporaries	Erwin Neuenschwander

Friday, July 30, 2021 13:00 – 14:00

Virtual Hall 5
CHCMS Business Meeting

Friday, July 30, 2021 13:00 – 15:00

Virtual Hall 1		
Symposium (Part 2/2) The role of universities in Soviet science - ID 224 Symposium organizer: Sergey Shalimov, Hirofumi Saito Chair: Sergey Shalimov, Hirofumi Saito		
13:00 - 13:30 A636 ID: 290	Science in the Soviet Satellites: East-German Research on an example of the Central Institute for Nutrition	Georgy Levit
13:30 - 14:00 A637 ID: 334	Genetics in Soviet universities in the "post-Lysenko" epoch	Sergey Shalimov
14:00 - 14:30 A638 ID: 345	Resuming the exchanges between Soviet and French universities after Stalin's death: the example of the mathematician A.N. Kolmogorov's visit to Nancy and Paris in 1958	Laurent MAZLIAK
14:30 - 15:00 A639 ID: 851	Soviet university seen from Japanese academia	Hirofumi Saito

Friday, July 30, 2021 13:00 – 15:00

Virtual Hall 2

Virtual Hall 2
ISHEASTM Meeting

Friday, July 30, 2021 13:00 – 15:00

Virtual Hall 3		
Symposium (Part 2/2) Reading the skies: exploring the intersection of ethnometeorology, folk traditions and meteorology (Commission on the History of Meteorology) - ID 418 Symposium organizer: Alexander Hall, Natalija Janc Chair: Alexander Hall		
13:00 - 13:30 A640 ID: 566	Manchester the rainy city: the emergence, popularisation and persistence of a meteorological myth	Alexander Hall
13:30 - 14:00 A641 ID: 644	Reading the skies: exploring the intersection of ethnometeorology, folk traditions and meteorology	Biswanath Dash
14:00 - 14:30 A642 ID: 1137	Climate at the margins: how consumer demand can exacerbate vulnerabilities to climatic fluctuations	Robert Naylor
14:30 - 15:00 A643 ID: 1147	The application of meteorology by the Republic of China in the development of rural areas, 1912-1949	Xiao Liu

Friday, July 30, 2021 13:00 – 15:00

Virtual Hall 4		
Symposium (Part 2/5) Art, image, and astronomical knowledge (ICHA/CHAMA) - ID 185 Symposium organizer: Sara J. Schechner, Yunli Shi Chair: Yunli Shi		
13:00 - 13:30 A644 ID: 652	Star atlas: ancient astronomy in the planetarium	Katie Boyce-Jacino
13:30 - 14:00 A645 ID: 246	Some thoughts on stellar constellations in rock art	Christiaan Sterken

Virtual Hall 4		
14:00 - 14:30 A646 ID: 503	Reconstruction of historical constellations	Susanne M Hoffmann
14:30 - 15:00 A647 ID: 254	The Hellenistic constellations through words and images	Stamatina Mastorakou

Friday, July 30, 2021 13:00 – 15:00

Virtual Hall 6		
Session XIX (Part 2/4) - History of Physics Chair: Petra Hyklová		
13:00 - 13:30 A648 ID: 1247	The introduction of vacuum tubes by the Imperial Japanese navy, 1914-1918	Kento Yokoi
13:30 - 14:00 A649 ID: 1123	Virtual Particles: From Hideki Yukawa to Richard Feynman	Jean-Philippe Martinez
14:00 - 14:30 A650 ID: 1198	Atomic fish: Sublime and non-sublime nuclear nature imaginaries	Anna Storm

Friday, July 30, 2021 13:00 – 15:00

Virtual Hall 7		
Symposium (Part 2/3) Interactions and interchanges in the history of science, technology, and medicine - ID 162 Symposium organizer: Hugh Richard Slotten, Geoff Bil Chair: Hugh Richard Slotten		
13:00 - 13:30 A651 ID: 393	Linnean taxonomy of the New Zealand fauna: From Cook's collections to modern genetics	Hamish Spencer
13:30 - 14:00 A652 ID: 396	Tracing the Artisan in a Philosopher's Practices	Catherine Abou-Nemeh

Virtual Hall 7		
14:00 - 14:30 A653 ID: 798	Missionaries and science in global context	John Stenhouse
14:30 - 15:00 A654 ID: 926	The making of green gold: An entangled history of medicinal plants introduced to the Philippines in the Age of the Galleons	Marianne Jennifer R. Datiles

Friday, July 30, 2021 13:00 – 15:00

Virtual Hall 8		
Symposium (Part 11/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 216 Symposium organizer: Janet Laidla, Sofia Talas Chair: Johannes-Geert Hagmann		
13:00 - 13:30 A655 ID: 1261	The second sense: 19th-century sound experiments in the Czech lands and why they came to be seen as peripheral	Anna Kvicalova
13:30 - 14:00 A656 ID: 1053	A failed object or a failure of an object? The Electrophone in Britain 1893 – 1935	Natasha Kitcher
14:00 - 14:30 A657 ID: 400	Visualization of Astronomical Interfusion: A Geocentric Armillary Sphere in the Qing Dynasty Palace in 1669	Nan Zhang
14:30 - 15:00 A658 ID: 1154	Horoscopes in the seventeenth-century Ottoman annual astrological predictions: Ḥüseyin Efendi's Aḥkām-ı ṭāliʿ-i sāl ve taḳvīm	Gaye Danışan

Friday, July 30, 2021 13:00 – 15:00

Virtual Hall 9		
Symposium (Part 2/2) They might be giants: lesser power and alternative channel efforts in science diplomacy (Commission on Science, Technology and Diplomacy) - ID 485 Symposium organizer: Sam Robinson Chair: Lif Jacobsen		
13:00 - 13:30	Ukrainian science diplomacy in interwar Central Europe	Martin Rohde

Virtual Hall 9		
A659 ID: 677		
13:30 - 14:00 A660 ID: 775	Building Europe through physics during the Cold War	Roberto Lalli
14:00 - 14:30 A661 ID: 917	They might be giants: lesser power and alternative channel efforts in science diplomacy - Part 2/2	Katrin Heilmann
14:30 - 15:00 A662 ID: 684	American 'Soft Power' in France, 1801-1851	Andrew Butrica

Friday, July 30, 2021 13:00 – 15:00

Virtual Hall 10		
Session XVI (Part 4/5) - Medicine Chair: Tereza Kopecká		
13:00 - 13:30 A663 ID: 1140	Quarantines in the Russian Empire: Entangled Histories of Medical Knowledge, Diseases and Policy Measures	Ekaterina Petrenko
13:30 - 14:00 A664 ID: 1202	Establishing Rapport: Gary Fisher's LSD Treatment of Autistic and Schizophrenic Children in the 1960s	Andrew Jones
14:00 - 14:30 A665 ID: 1081	The poliomyelitis in Mexico and its contribution to the progress and consolidation of orthopedics as a medical specialty in Mexico. 1946-1960	José Luis Gómez De Lara
14:30 - 15:00 A666 ID: 1239	Hilary Koprowski - the forgotten winner in the fight against polio	Weronika Marzena Lebowa

Friday, July 30, 2021 13:00 – 15:00

Virtual Hall 11
Symposium (Part 6/6) Transportation History: Vehicles of mobility - feet off the ground (ICOHTEC) - ID 533

Virtual Hall 11		
Symposium organizer: Timo Myllyntaus, Hugo Pereira Chair: Timo Myllyntaus		
13:00 - 13:30 A667 ID: 742	Lifts - A sign of wealth or the technical awareness development of the society?	Katarzyna Pietrzak
13:30 - 14:00 A668 ID: 773	Technical development of air transport in Slovakia in the context of political changes in 20th century	Ludovít Hallon Miroslav Sabol
14:00 - 14:30 A669 ID: 739	The Luxury on Wheels: Tourist Trains in the Interbellum Poland	Anna Turza
14:30 - 15:00 A670 ID: 859	Integrated railway modernization in inter-war Romania financed by international loans	Attila Gabor Hunyadi

Friday, July 30, 2021 13:00 – 15:00

Virtual Hall 12		
Symposium A comprehensive study on Isaac Newton's optical instruments - ID 106 Symposium organizer: Yoshimi Takuwa, Yoichi Hirano Chair: Yoshimi Takuwa		
13:00 - 13:30 A671 ID: 575	Newton's prisms in the Whipple Museum	Joshua Nall
13:30 - 14:00 A672 ID: 446	Newton's prism in the Royal College of Physicians	Lowri Jones
14:00 - 14:30 A673 ID: 735	's Gravesande's prisms in the Boerhaave Museum	Tiemen Cocquyt
14:30 - 15:00 A674 ID: 809	's-Gravesande's prisms in the Utrecht University Museum	Paul Lambers

Friday, July 30, 2021 15:30 – 17:30

Virtual Hall 1

Symposium Is there a place for software in socialist economy? (ICOHTEC) - ID 266

Symposium organizer: Helena Durnova, Simon Donig

Chair: Helena Durnova, Simon Donig

15:30 - 16:00 A675 ID: 427	"Through play, knowledge": Computer toys and the scientific-technological revolution in the GDR	Mario Bianchini
16:00 - 16:30 A676 ID: 534	Late socialist "open source" technologies: The case of the Czechoslovak Turbo 2000 loader for Atari home computers	Jaroslav Švelch
16:30 - 17:00 A677 ID: 870	Narrating computer history through the prism of popular technical knowledge infrastructure: the late Soviet case	Zinaida Vasilyeva
17:00 - 17:30 A678 ID: 960	The Siren Song of Socialist Silicon: Deriving Lessons for Contemporary Computing from Communist Czechoslovakia	Robert Jameson

Friday, July 30, 2021 15:30 – 17:30

Virtual Hall 2

Symposium Energy and the environment: conflict or compatibility (ICOHTEC) - ID 313

Symposium organizer: Anthony N Stranges

Chair: Anthony N Stranges

15:30 - 16:00 A679 ID: 313	Acid rain: causes, consequences, remedies, and regulations	anthony n stranges
16:00 - 16:30 A680 ID: 685	Energy transition in 20th & 21st centuries: challenges and environmental impact	Elena Helerea
16:30 - 17:00 A681 ID: 714	Climate change science - a paradigm and its opponents	Petter Wulff

Friday, July 30, 2021 15:30 – 17:30

Virtual Hall 3

Symposium Astronomical Handbooks, Tables, and Education in Islamic Societies - ID 669

Symposium organizer: Robert Morrison

Chair: Petra Schmidl

15:30 - 16:00 A682 ID: 794	Fazārī's Role in the Formation of the Genre of the Arabic Zījes	Taro Mimura
16:00 - 16:30 A683 ID: 831	Zij Yamini, a newly found Persian astronomical handbook from early 12th century	Mohammad BAGHERI
16:30 - 17:00 A684 ID: 886	Students as agents in the development of ʿAlī al-Qūshjī's al-Risāla al-Fatḥiyya: Astronomy education in Ottoman Constantinople	Hasan Umut
17:00 - 17:30 A685 ID: 1293	Explanation Necessary: 'Alī Qushjī's Commentary on the Zīj of Ulugh Beg	Robert Morrison

Friday, July 30, 2021 15:30 – 17:30

Virtual Hall 4

Symposium (Part 3/5) Art, image, and astronomical knowledge (ICHA/CHAMA) - ID 187

Symposium organizer: Sara J. Schechner, Yunli Shi

Chair: Katie Boyce-Jacino

15:30 - 16:00 A686 ID: 497	Well then, who dug 'them' canals on Mars?	David DeVorkin
16:00 - 16:30 A687 ID: 509	Re-discussion about the two celestial images unearth in Nara, Japan	Huichih Chuang
16:30 - 17:00 A688 ID: 291	Art and astronomical knowledge at Dendera in the 1st century BCE	Rosalind Park

Friday, July 30, 2021 15:30 – 17:30

Virtual Hall 6

Commission on Science and Literature Business Meeting

Symposium organizer: George N. Vlahakis, John Holmes
Chair: Konstantinos Konstantopoulos

Friday, July 30, 2021 15:30 – 17:30

Virtual Hall 7

Symposium (Part 3/3) Interactions and interchanges in the history of science, technology, and medicine - ID 163

Symposium organizer: Hugh Richard Slotten, Geoff Bil
Chair: Hugh Richard Slotten

15:30 - 16:00 A689 ID: 587	Paper chains: nature, commerce, and mediation in archives in the Dutch East Indies	Genie Yoo
16:00 - 16:30 A690 ID: 700	From hooker to cockayne, new zealand floras and handbooks, 1853-1934	Anton Sveding
16:30 - 17:00 A691 ID: 918	Global trade in human organs: historical perspectives	Susan Lederer
17:00 - 17:30 A692 ID: 826	From ethnoscience to ethnology - & back again: plant nomenclature, translation and territoriality in Aotearoa NZ	Geoff Bil

Friday, July 30, 2021 15:30 – 17:30

Virtual Hall 8

Symposium (Part 12/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 217

Chair: Silke Ackermann, Silke Ackermann
Symposium organizer: Janet Laidla

15:30 - 16:00 A693	The jewishness of jewish artefacts—jewish mathematical instruments and their medieval and	Josefina Rodriguez-Arribas

Virtual Hall 8		
ID: 674	contemporary narratives	
16:00 - 16:30 A694 ID: 361	Religion as a driving force for science: the knowledge of timekeeping	Taha Yasin Arslan
16:30 - 17:00 A695 ID: 605	Toward diverse global histories of science and technology: new strategies for displaying and interpreting Islamic instruments for wider audiences	Glaire Anderson
17:00 - 17:30 A696 ID: 395	Jesuit Observatories and Jesuit Science	Guy Consolmagno

Friday, July 30, 2021 15:30 – 17:30

Virtual Hall 9
Commission on Science, Technology and Diplomacy Meeting

Friday, July 30, 2021 15:30 – 17:30

Virtual Hall 10		
Session XXII - History of Teaching Chair: Petr Svobodný		
15:30 - 16:00 A697 ID: 1079	Uses of history of science and technology in british secondary physics textbooks from the 1870s to the present	Beto Pimentel
16:00 - 16:30 A698 ID: 1230	Creative transductive strategies to reduce the gaps: socio-economic inequality in the history and philosophy of primary education in Argentina	Sandra Visokolskis
16:30 - 17:00 A699 ID: 1219	History of scientists and men, between teaching and the history of science	Matteo Torre

Friday, July 30, 2021 15:30 – 17:30

Virtual Hall 11

Virtual Hall 11

Symposium Amateurs and vocational scientists: places of encounters, networks and scientific practices - ID 559

Symposium organizer: Irina Podgorny, Nathalie Richard

Chair: Irina Podgorny

15:30 - 16:00 A700 ID: 614	The pilot's house and the local pilots's collaboration in the scientific-naval expeditions in the Patagonian coast	Susana Valeria Garcia
16:00 - 16:30 A701 ID: 740	The messengers of science from paso de Cortés: measurements and experiments in high altitude mountains in Mexico, 19th century	Laura Chazaro
16:30 - 17:00 A702 ID: 866	The Salvador collection in Barcelona at the beginning of the 19th century: between the "curious public" and the "positive science"	Xavier Ulled
17:00 - 17:30 A703 ID: 976	Archaeology at the Hotel, Paleontology at the Café: scientific encounters in unexpected places	Nathalie Richard Irina Podgorny

Friday, July 30, 2021 15:30 – 17:30

Virtual Hall 12

Session XXIII (Part 1/2) - Science Theory and Praxis

Chair: Michal Šimůnek

15:30 - 16:00 A704 ID: 1280	Confucian scholars' attempts to complement the Chinese scientific tradition with western science	Yung Sik Kim
16:00 - 16:30 A705 ID: 1267	Creating a national time, adopting an international meridian: science in Brazil in the early 20th century.	Sabina Luz
16:30 - 17:00 A706 ID: 1193	Celebrity, media, and the construction of the environment under Franco's dictatorship in 1960s and 1970s Spain	Carlos Tabernero

Friday, July 30, 2021 18:00 – 18:55

Virtual Hall 6

Virtual Hall 6		
Sergey Demidov: Pafnuty Lvovich Chebyshev and the mathematical community of his time. On the occasion of the 200th anniversary of his birth (IAHS)		
18:00 - 18:55 A707 ID: 1332	Pafnuty Lvovich Chebyshev and the mathematical community of his time. On the occasion of the 200th anniversary of his birth (IAHS)	S.S. Demidov

Friday, July 30, 2021 18:00 – 20:00

Virtual Hall 1		
Symposium Red Giants, White Dwarfs: Twentieth-century astronomy and astrophysics (History of Physics)- ID 228 Symposium organizer: Jaume Navarro, Roberto Lalli Chair: Jaume Navarro		
18:00 - 18:30 A708 ID: 251	The Socio-Epistemic Networks of General Relativity, 1925-1970: The low-water mark, the renaissance, and the astrophysical turn	Roberto Lalli
18:30 - 19:00 A709 ID: 462	International astronomy in Chile. Scientists, politicians and the public in the 1960s	Barbara Silva
19:00 - 19:30 A710 ID: 381	Imaginings and icons: imaging the cosmic first light, 1974-2014	Connemara Doran
19:30 - 20:00 A711 ID: 391	Curved space on a flat surface: the Event Horizon Telescope and visual representations of black holes	Emilie Skulberg

Friday, July 30, 2021 18:00 – 20:00

Virtual Hall 2
Symposium Creating, maintaining and using technological systems: non-western actors - (ICOHTEC) - ID 159 Symposium organizer: Susan Schmidt-Horning, Jan Musekamp

Virtual Hall 2		
Chair: Fanxiang Min		
18:00 - 18:30 A712 ID: 267	Showing the way: maritime illumination in Japan, 1600-1900	Laura Nenzi
18:30 - 19:00 A713 ID: 528	A struggle between external aid and self-support: the financing of Puji Hospital in Dongguan, China	Yuping Zhou

Friday, July 30, 2021 18:00 – 20:00

Virtual Hall 3		
Symposium Knowledge and practice across borders: science in Islamic societies (CHOSTIS) - ID 550 Symposium organizer: Robert Morrison, Petra Schmidl Chair: Robert Morrison		
18:00 - 18:30 A714 ID: 642	The Arabic Translation of Marwazī's Kayhān Shināk̲ht	kaveh niazi
18:30 - 19:00 A715 ID: 676	Eearly-modern European astronomy and Iranian religious elites	Amir-Mohammad Gamini
19:00 - 19:30 A716 ID: 747	If the thumb is twitching … Palmomantic practices in Arabic sources	Petra G. Schmidl
19:30 - 20:00 A717 ID: 903	Science across the borders: al-Andalus and Byzantium in the 10th century	Miquel Forcada
19:30 - 20:00 A718 ID: 939	Andalusī pharmacognostical Ǧāmiʕ-texts: reflections on the evolution and dispersal of a local literary species	Theo Loinaz

Friday, July 30, 2021 18:00 – 20:00

Virtual Hall 4
Symposium (Part 4/5) Art, image, and astronomical knowledge (ICHA/CHAMA) - ID 188

Virtual Hall 4		
Symposium organizer: Sara J. Schechner, Yunli Shi Chair: Susanne M. Hoffmann		
18:00 - 18:30 A719 ID: 510	An early representation of a star pattern on an ancient Egyptian coffin of the first intermediate period (2181-2040 BCE)	Elizabeth Minor
18:30 - 19:00 A720 ID: 519	Iconography and the cross-cultural transformation of zodiacal astral science in antiquity	Mathieu Ossendrijver
19:00 - 19:30 A721 ID: 298	Images in Babylonian astronomical and astrological texts	John Steele

Friday, July 30, 2021 18:00 – 20:00

Virtual Hall 5		
Symposium (Part 2/2) Pedagogy beyond giants and dwarfs: using the history of science to enhance education and promote inclusiveness - ID 551 Symposium organizer: João Monteiro, Karen A. Rader		
18:00 - 18:30 A722 ID: 749	Changing pedagogical landscapes of the history of science and 'Two Cultures'	Karen Rader
18:30 - 19:00 A723 ID: 748	Reconstructing Early Modern Artisanal Epistemologies and an "Undisciplined" Mode of Inquiry	Tianna Uchacz Pamela Smith
19:00 - 19:30 A724 ID: 786	History in the education of scientists: Encouraging judgment and social action	Vivien Hamilton
19:30 - 20:00 A725 ID: 790	Co-teaching Botany and History: An Interdisciplinary Model for a More Inclusive Curriculum	Frederica Bowcutt Tamara Caulkins

Friday, July 30, 2021 18:00 – 20:00

Virtual Hall 7

Virtual Hall 7		
Symposium Scientific and Cultural Influences of Ptolemy in China - ID 517 Symposium organizer: Efthymios Nicoladis, Dalong Lu		
18:00 - 18:20 A726 ID: 814	Data analysis of the historical records of Sun, Moon and planets in Ming Shilu	Liping MA
18:20 - 18:40 A727 ID: 856	Ptolemaic Planetary Theory in Qizheng Tuibu (1477)	LU Dalong
18:40 - 19:00 A728 ID: 857	Studies of MYTWS Versions: Communication of Ptolemaic astrology from Islam	HAN Dongyang
19:00 - 19:20 A729 ID: 1077	A study on Ferdinand Verbiest ' s star catalogue	Fan YANG
19:20 - 19:40 A730 ID: 919	From Nestorians to Matteo Ricci: Ptolemaic Influences in China	Kam Wing FUNG
19:40 - 20:00 A731 ID: 1170	Preliminary study on the inner planets observations of Ptolemy in Chongzhen Lishu	Changwei Zhu

Friday, July 30, 2021 18:00 – 20:00

Virtual Hall 8		
Symposium (Part 13/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 218 Symposium organizer: Janet Laidla Chair: Stephen Johnston, Stephen Johnston		
18:00 - 18:30 A732 ID: 409	The 'Physikalisches Kabinett' of the Prince-Bishops of Würzburg – A Roman-Catholic Collection?	Raphael Beuing
18:30 - 19:00 A733 ID: 417	Instruments to measure character – religious practitioners and psychological testing in the United States, 1920-1940	Peggy Kidwell
19:00 - 19:30	What's in a label?: 'Science' and 'Religion' in a museum	Mathilde DAUSSY-RENAUDIN

Virtual Hall 8		
A734 ID: 571	context.	
19:30 - 20:00 A735 ID: 379	Science and religion – knowledge and faith. A practical museum approach	Silke Ackermann

Friday, July 30, 2021 18:00 – 20:00

Virtual Hall 9		
Symposium Constructing interfaces between mathematical and physical conceptions and methods, c.1850–1930 - (ICHM) (with IMU) ID - 97 Symposium organizer: Raffaele Pisano Chair: Raffaele Pisano		
18:00 - 18:30 A736 ID: 800	Repeating the words of power: Hamiltonian dynamics and physical speculation in late nineteenth century Britain	Isobel Falconer
18:30 - 19:00 A737 ID: 801	(No) Love at first sight - group theory and quantum mechanics	Martina Schneider
19:00 - 19:30 A738 ID: 808	High dimensional spaces and mechanical systems	Jesper Lützen

Friday, July 30, 2021 18:00 – 20:00

Virtual Hall 10		
Symposium (Part 2/2) Symposium_Gender and technological systems (ICOHTEC) - ID 120 Symposium organizer: Susan Schmidt-Horning, Peeter Müürsepp Chair: Alexander Magoun		
18:00 - 18:30 A739 ID: 138	Women making noise: sound, power and gender from stage to studio	Susan Schmidt Horning
19:00 - 19:30 A740	Finding reproductive freedom in biologistic thinking	Jiemin Tina Wei

Virtual Hall 10		
ID: 292		
19:30 - 20:00 A741 ID: 306	"Boys will be boys": gender, plug sockets, and electrical safety in the interwar British home	Alona Bach

Friday, July 30, 2021 18:00 – 20:00

Virtual Hall 11		
Symposium Technological Teams (ICOHTEC) - ID 616 Symposium organizer: Susan Schmidt-Horning, Jiří Janáč Chair: Maria Elvira Callapez		
18:00 - 18:30 A742 ID: 959	From big science to team science	Glenda Turner
18:30 - 19:00 A743 ID: 984	Vicente Marcano (1848-1891), polymath chemist, discoverer of the Bromelain enzyme, and father of experimental science in Venezuela	José Álvarez-Cornett
19:00 - 19:30 A744 ID: 995	Invention or Business? Pioneers of the television technology and industry -Vladimir Zworykin and David Sarnoff.	Vasily Borisov

Friday, July 30, 2021 18:00 – 20:00

Virtual Hall 12		
Session XXIII (Part 2/2) - Science Theory and Praxis Chair: Michal Šimůnek		
18:00 - 18:30 A745 ID: 1027	Denialism in Brazil: a review of the dispute between post-thuth and science	Vagner Ramalho
18:30 - 19:00 A746 ID: 1152	Hierarchy within the Soviet scientific community: filters and positions of the 1920s	Evegeniya Dolgova
19:00 - 19:30 A747	Scientific fakery: from the early modern to contemporary times	Marlis Hinckley

Virtual Hall 12		
ID: 1275		

Friday, July 30, 2021 20:00 – 21:00

Virtual Hall 3
Business Meeting of CHOSTIS

Saturday, July 31, 2021 10:00 – 12:00

Virtual Hall 1		
Symposium (Part 4/4) Mathematical proofs and styles of reasoning: East vs. West - ID 226 Symposium organizer: Jens Lemanski, Ioannis Vandoulakis, Eberhard Knobloch Chair: Ioannis Vandoulakis		
10:00 - 10:30 A748 ID: 373	Abū al-Barakāt's diagram method in logic	Wilfrid Hodges
10:30 - 11:00 A749 ID: 476	Geometry and Arithmetic-Analysis and Synthesis in Ancient Greek Mathematical Tradition	Kostas Nikolantonakis
11:00 - 11:30 A750 ID: 858	Understanding computer-assisted proofs	Yiannis Kiouvrekis Petros Stefaneas

Saturday, July 31, 2021 10:00 – 12:00

Virtual Hall 2		
Symposium (Part 5/5) Art, image, and astronomical knowledge (ICHA/CHAMA) - ID 190 Symposium organizer: Sara J. Schechner, Yunli Shi Chair: Christiaan Sterken		
10:00 - 10:30 A751 ID: 500	Knowledge, art and politics in copies of 'Abd al-Rahman al-Sufi's Book of the Star Constellations	Sonja Brentjes
10:30 - 11:00	Charting the Chinese Sky with Western Observations: The Star	Yunli Shi

Virtual Hall 2		
A752 ID: 297	Maps Made by Jesuit Astronomers in the Late Ming Dynasty Revisited	

Saturday, July 31, 2021 10:00 – 12:00

Virtual Hall 3		
Symposium The politics of radiation protection - ID 234 Symposium organizer: Maria Rentetzi, Ana Barahona Chair: Maria Rentetzi, Ana Barahona		
10:00 - 10:30 A753 ID: 253	Technologies and atomic knowledge for a history of radiation in Spain in the 1960s	Ana Romero de Pablos
10:30 - 11:00 A754 ID: 785	The Eastern bloc countries and the International Atomic Energy Agency: knowledge transfer and radiation protection	Irina Fedorova
11:00 - 11:30 A755 ID: 787	How the United Nations conceived nuclear rights	Linda Marie Richards
11:30 - 12:00 A756 ID: 940	The introduction of radiation protection rules in postwar Greece through IAEA fellowships	LOUKAS FRERIS

Saturday, July 31, 2021 10:00 – 12:00

Virtual Hall 4		
Session XVI (Part 5/5) - Medicine Chair: Petr Svobodný		
10:00 - 10:30 A757 ID: 1243	The 1954 Flood, Sanitation Campaign, and the Re-Making of Medical Infrastructure in Early Communist China	Yue Liang
10:30 - 11:00 A758 ID: 1255	Histories of Healing: Traditional and Local Medicine in Times of Pandemic	Andrea Núñez Casal
11:00 - 11:30	100 years since the discovery of insulin – giants and dwarfs	Iuliana Popescu

Virtual Hall 4		
A759 ID: 1268	who made it possible	
11:30 - 12:00 A760 ID: 1071	Calculating prodigies as evidence for phrenology in Europe	Andrea Graus

Saturday, July 31, 2021 10:00 – 12:00

Virtual Hall 5		
Symposium Institutions and science and technology in modern China ----new approaches (ISHEASTM) - ID 28 Symposium organizer: Iwo Amelung, Yunli Shi		
10:00 - 10:30 A761 ID: 57	The Comité scientifique du Kiang-nan and the Catholic Critique of Evolutionism in Modern China	Joachim Kurtz

Saturday, July 31, 2021 10:00 – 12:00

Virtual Hall 6		
Session XIX (Part 3/4) - History of Physics Chair: Petra Hyklová		
10:00 - 10:30 A762 ID: 1134	Name, identity, and discipline formation: the development of Busseiron in Japan	Hiroto Kono
10:30 - 11:00 A763 ID: 1174	Physics in the field: expeditions and field stations in the 20th century	Adriana Minor
11:00 - 11:30 A764 ID: 1260	Where Nobel Laureates and Nameless meet. The significance of "science for all" events to CERN's mission in the 1970s	Barbara Hof

Saturday, July 31, 2021 10:00 – 12:00

Virtual Hall 7

Virtual Hall 7		
Session XVII (Part 2/2) - Science and Philosophy Chair: Tomáš Hermann		
10:00 - 10:30 A765 ID: 1158	Chien-Shiung Wu in Experimental Philosophy	Indianara Silva
10:30 - 11:00 A766 ID: 1217	About the history of the development of quality methods: from the local approach to the global one	Egor Bogatov
11:00 - 11:30 A767 ID: 1225	The turning points in the history of science of science	Michal Kokowski
11:30 - 12:00 A768 ID: 1114	Cooperation between dwarves and science giants to overcoming conceptual borders and build a scientific philosophy of sustainability	Victor Hugo Oliveira Pinto

Saturday, July 31, 2021 10:00 – 12:00

Virtual Hall 8

ICOHTEC Prize Session

Chair: Maria Elvira Callapez, Darina Martykánová, Yoel Bergman

Maurice Daumas Prize

Winners:

Dominique Berry
Stefan Esselborn
Sara Caputo

Turriano ICOHTEC Prize

Winners:

Hyeok Hweon Kang
Martin Meiske
Philippe Bruyèrre

Saturday, July 31, 2021 13:00 – 14:00

Virtual Hall 7

Virtual Hall 7

INHIGEO Meeting

Saturday, July 31, 2021 13:00 – 15:00

Virtual Hall 1

Symposium They Might Be Giants: Histories of Failed Science Diplomacy Initiatives (Commission on Science, Technology and Diplomacy) - ID 486

Symposium organizer: Sam Robinson

Chair: Sam Robinson

13:00 - 13:30 A769 ID: 675	Digging in the dirt: uranium diplomacy, development, and the IAEA	Matthew Adamson
13:30 - 14:00 A770 ID: 745	European technoscientific diplomacy and the Fukushima nuclear emergency. A diplomatic meltdown?	Maria Paula Diogo
14:00 - 14:30 A771 ID: 811	A "paper tiger" in science diplomacy? Scientific initiatives through SEATO, 1954-1977	Simone Turchetti
14:30 - 15:00 A772 ID: 863	On the Road to Stockholm: Prague Symposium on Problems Relating to Environment, 1971	Doubravka Olšáková

Saturday, July 31, 2021 13:00 – 15:00

Virtual Hall 2

ICHA Meeting

Saturday, July 31, 2021 13:00 – 15:00

Virtual Hall 3

Symposium Environmental change and energy systems - (ICOHTEC) - ID 123

Symposium organizer: Susan Schmidt-Horning, Peeter Müürsepp

Chair: Peeter Müürsepp

Virtual Hall 3		
13:00 - 13:30 A773 ID: 140	"The latent heat of vaporization is totally lost": can solar energy be a risk for sustainability?	Nelson Arellano

Saturday, July 31, 2021 13:00 – 15:00

Virtual Hall 4		
Symposium The little people of "big science": the image of the ordinary scientist in late soviet culture - ID 537 Symposium organizer: Aleksandr Fokin		
13:00 - 13:30 A774 ID: 838	Materialistic wizards: scientists in soviet science fiction	Aleksandr Fokin
13:30 - 14:00 A775 ID: 842	American Images of the Soviet science in the Cold war (1950-1980s)	Dmitry Nechiporuk
14:00 - 14:30 A776 ID: 869	Soviet Women and Big Science: Gender in Siberian Academy (1957-1980s).	Mikhail Piskunov

Saturday, July 31, 2021 13:00 – 15:00

Virtual Hall 6		
Session XIX (Part 4/4) - History of Physics Chair: Petra Hyklová		
13:00 - 13:30 A777 ID: 1183	Diamilla Muller's early simultaneous magnetic observation efforts	Vitor Bonifácio
13:30 - 14:00 A778 ID: 1004	Britain's Atomic Energy Strategy towards Japan: The Anglo-American "Special Relationship", 1939-1959	Kenzo Okuda
14:00 - 14:30 A779 ID: 1264	How Europe chose not or wasn't able to become a Giant in human spaceflight	Piero Messina

Saturday, July 31, 2021 13:00 – 15:00

Virtual Hall 8

Symposium (Part 14/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 219

Symposium organizer: Janet Laidla

Chair: Marta Lourenço, Louise Devoy

13:00 - 13:30 A780 ID: 423	The vatican observatory historical collections: a different perspective on the connection between science and religion	Ileana Chinnici
13:30 - 14:00 A781 ID: 366	The great meridian circle of Reichenbach and Ertel in Tartu Observatory	Lea Leppik
14:00 - 14:30 A782 ID: 247	Instruments of the short-lived Tallinn Naval Observatory	Janet Laidla
14:30 - 14:45 A783 ID: 1105	E-POSTER Jacquard controversial invention between science and technology	Emma Angelini

Saturday, July 31, 2021 14:00 – 15:00

Virtual Hall 7

IASCUD Business Meeting

Saturday, July 31, 2021 15:30 – 17:30

Virtual Hall 1

Dissertation Prize Winners

Chair: Mike Osborne

DHST President hosts a session in honor of DHST Dissertation Prize laureates from the 2019 and the 2021 prize competitions. Laureates will present a 10-minute appreciation of their research followed by up to 5 minutes of questions. The laureates and the titles of their dissertations in projected order of appearance are:

Sandra Elena GUEVARA FLORES, "The sociocultural construction of Cocoliztli in the epidemic of 1545 to 1548 in New Spain," [La construcción sociocultural del cocoliztli en la epidemia de 1545 a 1548 en la Nueva España] (Autonomous University of Barcelona, 2017. Director: Dr. José Pardo.

Virtual Hall 1

Marcin KRASNODĘBSKI, "The Pine Institute and Resin Chemistry in Aquitaine (1900-1970)," [L'Institut du Pin et la Chimie des Résines en Aquitaine (1900-1970)] (University of Bordeaux, 2016. Director: Pascal Duris).

Charles A. KOLLMER, "From Elephant to Bacterium: Microbial Culture Techniques and Chemical Orders of Nature, 1875 – 1946," (Princeton University, 2020. Director: Angela Creager).

F**ateme SAVADI,** "The Historical and Cosmographical Context of Hayʾat al-arḍ with a Focus on Quṭb al-Dīn Shīrāzī's Nihāyat al-Idrāk," (McGill University, 2018. Director: F. Jamil Ragep). Dr. Savadi is also the recipient of the İhsanoğlu Prize for the best dissertation on science and Islamic civilization funded by the Istanbul Foundation for Research and Education (ISAR). The Turkish Society of History of Science has graciously funded the İhsanoğlu Prize for the Congress following Prague 2021.

Sooyoung AN, "Cross-cultural Transfers of Chinese Materia Medica Knowledge in the Eighteenth and Nineteenth Centuries: Toward a Global History of Natural Knowledge," [十八、十九世纪中国药材知识的跨文化互动研究 ——以知识的多样与连接为视角] (National Institute for Advanced Humanistic Studies, Fudan University, Shanghai, 2019. Director: Shaoxin Dong).

Circumstances prevent these laureates from presenting today:

Johan GÄRDEBO, "Environing Technology: Swedish satellite remote sensing in the making of environment, 1969–2001," (KTH Royal Institute of Technology, Stockholm, 2019. Director: Nina Wormbs).

Emily Margaret KERN, "Out of Asia: a global history of the scientific search for the origins of humankind, 1800- 1965," (Princeton University, 2018. Directors: Erika Lorraine Milam and Michael Gordon).

Saturday, July 31, 2021 18:00 – 20:45

Virtual Hall 1

General Assembly

LIST OF SYMPOSIA

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ABSTRACTS

Plenary symposium Pandemics, science, and society - ID 318

Contribution ID: 852
What is an epidemic?

Warwick Anderson
Department of History, University of Sydney, Sydney NSW, Australia

Through history of science, I address practices, ontological politics, and ethics of contemporary epidemic disease modelling, especially in relation to Covid-19. I ask how we got here from there. In 1948, Erwin Ackerknecht discerned three divisions among nineteenth-century epidemiologists. There were those focused on geographic causes of disease, on environmental correlates of outbreaks. Others invested in 'social medicine' emphasised political and economic influences on the distribution of disease. With the development of germ theories late in the century, a third group concentrated on the technics of microbial transmission, on contact and source tracing. In 1992, Charles Rosenberg reworked this categorisation as the difference between epidemiologists seeking complexity in their models, interested in the *configuration* of disease outbreaks, and those content with simple microbe 'hunting', thinking in terms of *contamination*. In the twentieth century, configurational impulses still were expressed marginally in the new disease ecology and residual social medicine. Thus, Rosenberg could frame epidemic disease as a social index or 'sampling technique', revealing a cross-section of cultural patterns and social practices. With the emergence of diseases such as AIDS, more epidemiologists turned to ecology to understand biological and environmental complexity. In the past forty years, outbreak modelling has derived largely from this ecology, transforming earlier 'contamination' assumptions of Cold-War epidemic intelligence. But in trying to understand biologically the transmission of SARS-CoV-2, modellers continue to neglect social and cultural complexity, often resorting to simplistic contamination models that focus on contact and taint. Is another politics of microbial life possible?

Contribution ID: 716
Bolsonaro's chloroquine: science, pandemic, and pandemonium in Brazil

Marcos Cueto
Casa de Oswaldo Cruz, Fiocruz, Rio de Janeiro, Brazil

One of the most salient features of Covid-19 in Brazil --the most affected Latin American country by the coronavirus—was the tragic feedback between the pandemic and irrational official responses. A salient response was the stubborn glorification by President Bolsonaro of a quick fix, chloroquine and hydroxychloroquine. He even recreated the distinction between treatment and prevention by arguing that the drug was the alternative to social distancing and clashed with mayors and state governors who had ordered confinement to stop the progress of the disease. In this paper I will describe Bolsonaro's obsession with a magic bullet; the reception of French scientists Didier Raoult's early controversial claims on these drugs; Bolsonaro's devotion to President Donald Trump who made similar claims, the reactions of Brazilian scientists and physicians, and Bolsonaro's confrontation with state governors and his own Health Ministers. I will argue that Bolsonaro's actions were not only based on his stance against scientific

evidence and science itself. It illustrates a distinctive historical entanglement of science and politics in a developing country. It resulted from years of neoliberal policies that minimized local medical research, national drug production and regulation and the reinforcement of Brazil's public health system. It also exemplified a typical Latin American pattern of official temporary responses to epidemic outbreaks that overemphasized technology, disdained community participation in health systems and ignored social inequalities that multiply epidemics in impoverished shantytowns and rural areas with poor basic sanitation.

Contribution ID: 388

Genetic engineering and prospects for living in a pandemic

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Pandemics take place not only in the past and the present—as we well know—but also in the future tense. At the dawn of the era of genetic engineering, molecular biologists at the famed 1975 Asilomar conference wrangled with the potential biohazards of recombinant DNA research, exchanging speculative possibilities concerning contamination and containment. They came to explicitly and repeatedly frame their concerns within the language of science fiction, and with direct reference to Michael Crichton's *Andromeda Strain* (1969) in particular. These fictional fears of a future pandemic ultimately even came to affect technical strain development, laboratory design and public health policy measures. While many participants derided such invocations of fiction as sensationalism and "molecular politics," this episode suggests that we would do well to seek to understand the unexpected and sometimes unruly cultural narratives in which science is always embedded, as conceptual, scientific, and regulatory frameworks governing scientific commerce with the heavens above (exobiology) were invoked to envision policy solutions to potential hazards in the engineering of life here on Earth. Confronted with an all-too-real pandemic today, it is striking to see similar fears and tropes resurrected. With new attention to speculative futures (predictions, projections, models) and a new generation of the biotech industry rapidly retooling to confront the challenges posed by COVID-19, what insights might we gain from the continued unexpected juxtaposition of "scientific models" and "science fiction novels"?

Contribution ID: 665

Commentary

Mary Brazelton
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This contribution will offer reflections on the papers by Warwick Anderson (What is an epidemic?), Marcos Cueto (Bolsonaro's chloroquinine: science, pandemic, and pandemonium in Brazil), and Luis Campos (Genetic engineering and prospects for living in a pandemic). The commentary on these papers will offer thoughts on the uses of history in contemporary epidemic crises; the significance of postcolonial, transnational, and global historical narratives; and the ways in which the papers suggest we should respond to Covid-19 as historians of science and medicine. Particular reference will be made to the role of China and the experience of East Asia in emerging narratives of the pandemic.

Symposium Social factors in the passage from invention to technological system - ID 161

Contribution ID: 531

Making an invention known. Importance of the socio-economic network in the innovation processes concerning architectural terracotta, France, 19th century

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In the nineteenth century, the field of architectural terracotta experienced a period of intense invention, around new models and processes supposed to save time, raw material and energy. In France, in 1855, a new patent was filed every five days, half of which concerned mechanical tiles. However, not all of these new models, although technically equivalent, have been equally successful and have not been integrated into the socio-technical network as innovations: a majority soon fell into oblivion.

It appears that the key criterion that led some models, and their producers, to become "giants" of this industry, instead of remaining "dwarves" with local influence or even disappear, was first and foremost the ability of inventors to mobilize a socio-economic network. Some scholarly societies, in particular the *Société d'Encouragement pour l'Industrie Nationale*, offered competitions, which allowed to win prizes but also to have articles published in technical journals. Industrial exhibitions or advertising brochures were also good ways to make an invention known, and consulting engineers could be hired to manage this communication strategy. However, all of these steps involved a cost and the need for a preexisting social network: by exploiting an open corpus of patents and publications, we propose to highlight the importance of these networks in transforming a "dwarf" of invention into a "giant" of innovation.

Contribution ID: 532

Processes at work in the emergence and militarization of a technological system: seaplanes in France in the 1910s

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History of aeronautics usually focuses on success stories regarding a particular inventor, machine or event, to mark turning points, such as the Blériot flight accross the Channel and the commercial success of his Blériot XI plane. This does not always allow to uncover the processes in place in the invention and innovation approaches, leading to the implementation of the aircraft technological system, its integration in a military and global technological culture.
The purpose of our paper is to highlight the modalities and processes of creation and maintain of a technological system centered on seaplanes in the 1910s, and of its inscription in the military frame, from the scale of the inventor (as an individual, the « dwarf » of the system) to the one of the emerging seaplane squadrons (the army being the « giant ») at the outbreak of World War One.

Conceptualizations, experimentations, possible transfers or hybridizations are key points of the study, relying on military archives, surviving letters and documents of the seaplane manufacturers, journalistic material, iconography, and patents.

Contribution ID: 936

Clean and save food for the urban consumer: the modernization of yoghurt production

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The article pays particular attention to the understanding of what is clean, hygienic and safe food; these concepts are developed during the process of food industrialization and mass production. The study focuses on the process of standardization of milk production for the Bulgarian urban cities during the 30s and 40s of the 20th century. The paper analyses in a critical manner the very understanding of *clean* and *dirty* through studying the discourses of science and technology. The research traces the transformation of dairy from a home-made to a mass product. The justification of the industrial food production went hand in hand with diverse symbolic and discursive fights between the supporters of the traditional technological knowledge and the scientists. The introduction of strict rationalized practices for milk quality and safety control was part of the scientists' instruments to regulate the mass-produced food but also marked a new discursive shift where the traditional yoghurt production was replaced by controlled and rationalized practices. These scientific principles opposed the received wisdom; thus the old methods of dairy production acquired the reputation of being backward, primitive, and unscientific. The modern approach generated alternative food production know-how and practices. Even though most of these were based on traditional methods, they were translated into the language of science. The second major effect was replacing farm women as the main producers of dairy with urban male workers in the dairies by means of professional education.

Symposium The perils of prediction – ID 349

Contribution ID: 776

Prediction in and about science

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There are questions at two levels about prediction in relation to science: how important it is that science makes successful novel predictions, and whether we can predict the future of science itself. Regarding the first question, many philosophers and scientists (including Imre Lakatos and Karl Popper) have especially valued the ability of science to make novel predictions, sometimes to the point of regarding it as the defining characteristic of science. Following Stephen Brush and others, I will argue that the acknowledged ability of modern science to make successful predictions is only as valuable as its ability to organize and explain previously known phenomena. Regarding the second question, I will argue that scientists and others have been very unsuccessful in predicting the course of the development of science

itself. The uncertainty about the staying power of scientific theories, even predictively successful ones, also raises a serious question about the value of predictive success. The final lesson from these reflections is one of humility: true foresight consists in recognizing the limits of our foresight.

Contribution ID: 627
Engineering, prediction, and mathematics

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The status of engineering heavily relies on predicting the behavior of the human built world. Does the ability for predictions depend on scientific knowledge, or does it rest on different grounds? This question has led to fierce debates in the late 19th century. At the 1895 General Assembly of German Engineers in Aachen, the „Anti-Math Movement" constituted itself and called for expelling mathematicians from technical institutes and the education of engineers. Most historical studies take for granted that mathematization automatically puts science above engineering—and that this motivated the Anti-Math Movement in German engineering.
My paper defends the opposite claim: How mathematics is used to make predictions in fact strongly contributed to the aspired autonomy of engineering knowledge. The Anti-Math Movement led to a new conception of mathematization that granted prediction a pivotal role.
After briefly examining two main opponents in the movement—the Göttingen mathematician Felix Klein and the Berlin engineer Alois Riedler—my talk focuses on the work of Carl von Bach (1847-1931), mechanical engineering professor at Stuttgart. He was not only a most influential actor in the „Anti-Math Movement", though behind the scenes, but also brought forward a hybrid concept of mathematization. This concept has two characteristics:
(i) Mathematical modeling is embedded into laboratory and experimental practice – an approach that shaped engineering education for generations.
(ii) This concept is oriented at prediction in a way that supports claims for the autonomy of engineering knowledge.

Contribution ID: 757
The perils of predicting complex systems: And what we can do without prediction

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In the study of highly complex systems such as complex biological or coupled human and nature systems (so-called CHANS in environmental science) reliable predictions are considered a primary purpose for building complex simulation models. Such models are themselves highly sophisticated using the affordances of modern computation to replicate the complexity of the systems under study to a large degree, rather than working with highly idealized representations. We explore some of the limitations of such a strategy in the case of both large scale modeling in systems biology and various interdisciplinary large-scale modeling strategies in the environmental sciences. Both sets of modeling strategies have faced criticism, insofar as they are intended to produce predictions which can be relied upon in policy or clinical settings. We examine those criticisms, some of which relate to problems which emerge from the

complexity of the mathematics involved and inevitable nonlinear sensitivity of such models; some of which emerge from problems of combining models of different scales across disciplinary boundaries; and some which arise from basic uncertainties regarding stakeholders values. Given the depth and extensiveness of such problems reliable prediction is at least to a certain degree of precision a questionable pursuit and may in fact produce poor policy outcomes. But complex simulation modeling has certain flexibilities and capacities which render it useful for other purposes once predictive goals are put to one side. We consider some of these practices which may require different accounts of the value and purposes of modeling than philosophers traditionally employ.

Contribution ID: 593

The many faces of prediction. Lessons from the various astronomical expeditions organized in the 1910s to test Einstein's light bending prediction

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On 6 November 1919, at the joint meeting of the Royal Society of London and the Royal Astronomical Society, the results of the two British expeditions, which observed the total solar eclipse of 29 May 1919 were announced.
The four British expeditioners – astronomers A.S. Eddington, C.R. Davidson, A.C.C. Crommelin, and clock mechanisms' expert E.T. Cottingham – observed the background of stars behind the sun, and following a hard work of data analysis spanning the summer of 1919 confirmed the light bending prediction by Einstein's recent general relativity theory.
Since 1911, while the theory was still under development, light bending was already anticipated with a value half of its correct one. Expeditions were organized in 1912, 1914 and 1918, involving teams of astronomers of different nationalities, but they were unsuccessful due to a variety of reasons, ranging from meteorological to geopolitical.
During the 1910s the theory of general relativity was far from being a fully-fledged scientific theory, hardly known, let alone understood, by the physical community, Einstein's capital of credit was still on the rise, and most astronomers' knowledge of physics was deficient. Granting all former factors, how does one explain astronomers' interest in testing light bending, under very taxing, if not outright dangerous, conditions? How do cognitive flows, which have not yet become accepted knowledge, transgress disciplinary boundaries and turn into successful predictions? Does success need qualifications, and if yes, under what circumstances? These are the questions to be addressed in this talk.

Symposium (Part 1/2) Giants and dwarfs in the transformations of mathematics in the XVIII century - ID 1006

Contribution ID: 480

Updating and innovation in Mathematics at the beginnings of the Spanish College of Artillery (1764-1808)

Juan Navarro-Loidi

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Mathematics was the main subject of the syllabus of the Spanish College of Artillery from its beginning. The promoter Count Gazzola considered that updated mathematics had to be taught and he looked for having good mathematicians as First Professor. The Jesuit Eximeno, the officer of the Army and then of the Navy Vimercati and the Italian Giannini were in charge of that position and, after few starting years, they taught Algebra applied to Geometry, Calculus and Mechanics using differentials. The contents of the courses were quite updated, but little research work was done in mathematics. Eximeno printed a book about philosophy and mathematics, but long time after being expelled from the College and from Spain. Only Giannni, the most long-lasting professor, published some research works during his stay in the College of Artillery. The matters of his researches were quite secondary and linked to questions debated during the first half of the century. Nevertheless they have some interest and show that Giannini was a trained mathematician.
But, he wasn't good in awakening interest in mathematics. Even if the officers of artillery got a good knowledge of mathematics in the College, no one continued working in mathematics, except as professors of the College itself. During these decades, there were officers of artillery graduated in the College and known as specialist in Chemistry, such as Munarriz, or in Economy, such as Alcalá Galiano; but no famous mathematicians.

Contribution ID: 582

Pasqual Calbó, a Minorcan scientist-artist, and his mathematical course (c. 1800)

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Pasqual Calbó (1752-1817) combined his work and talent as painter and draughtsman with the teaching of a course of mathematics. Calbó lived in Minorca and he spent nine years in Venice, Rome and Wien for his training as artist. He surely took advantage of this stay to learn mathematics, i.e. pure and mixed mathematics, probably to perform his ability for perspective or architecture. Calbó prepared un course to teach "young Minorcan artisans" that is preserved in a manuscript of around 500 fols., written in Minorcan, containing pure mathematics (decimal fractions, algebra, geometry, trigonometry, logarithms), experimental physics, perspective, architecture, sundials, and building of boats. The text provides us a striking example of private technical education. As it is well known, the schools of technical education were in process of consolidation in the second half of the XVIII century. Mathematics (including mixed mathematics) were considered the basis of technical education and played a relevant role in these early schools. Engineers, architects, artisans had gained their mathematical training through private courses and handbooks usually prepared by private teachers or persons in charge of exams to join the army or to obtain technical qualifications. Calbó's course is an interesting example of private technical education, generally not available, but probably highly diffused in Europe around 1800.
References:
DEAR, P. "Mixed Mathematics", in HARRISON, P. et al (ed.) *Wrestling with Nature*, UCP, 2011, 149-172.
ROCA ROSELL, A. et al (ed.) *Pasqual Calbó i Caldés. Obra científica*. Vol. 1. Maó, Barcelona, IME, IEC, 2020

Contribution ID: 599

Reflections from mixed mathematics to physic mathematics in Spanish eighteenth century

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This symposium wishes to reflect on the changes that occurred in mathematics between the middle of the 17th and the end of the 18th century, through the contributions of some dwarfs. In this talk we focus specifically on the treatment of new mathematical methods taught in the training of engineers in Spain.
In Spain, as in other countries, the origins of "scientific" engineering lay in the Army, where officers acquired their training informally. After the War of Succession (1701-1714), the Spanish Bourbon Monarchy played a relevant role in the scientific and technologic development by establishing several institutions to promote a higher education for the officer corps, and mathematics constituted a pillar of Academy's curriculum.
In 1739, a Royal Ordinance established the contents of the course in mathematics to be taught in the academies. This course, prepared by Pedro Lucuce (1692-1779), consisted of eight treatises with a total of approximately 2,200 pages long on the main fields of mathematics, including "pure" mathematics (arithmetic and geometry), and "mixed" mathematics (cosmography, statics, hydraulics, architecture, artillery, and fortification). Since we know that the logarithms, the algebra and the trigonometry are well developed in these texts, we analyse the treatment given to mixed mathematics and physical mathematics in this course, in order to compare and reflect on the features of contributions dealing in this text with other European countries.

References:

MASSA-ESTEVE, M. R. "La Reial Acadèmia de Matemàtiques de Barcelona (1720-1803). Matemàtiques per a enginyers." *Quaderns d'Història de l'Enginyeria*, Vol. XIV, 2014, 17-34.

Session I (Part 1/2) - History of Astronomy

Contribution ID: 997

Diversifying modern astronomy: a history of academic activism

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Astronomy is usually concerned with matters very distant from Earth. Most phenomena, whether observed or theorized, transcend human spaces and timescales by orders of magnitude. Yet, many astrophysicists have been interested not just in events "a long time ago in a galaxy far, far away," but also in their society here and now. Since the 1980s, an increasing number of them have pursued parallel careers as academics and activists. Besides publishing peer-reviewed papers, they have promoted a great variety of underrepresented groups within their discipline. Through working groups, conferences, newsletters and social media, they have sought to advance the interests of women, members of racial

and ethnic minorities, LGBT and disabled people. While these activists have differed in the identities they focus on, they have come to share a conviction that diversity and inclusion are crucial for scientific excellence as well as social justice. This paper presents the biographies and institutional contexts of several key agents in the diversification of modern astronomy during the late twentieth and early twenty-first centuries. Because they are recent figures whose discoveries have not been commemorated by Nobel Prizes, they are relatively unknown among historians of science. However, they have been central to discussions about who has privileged access to giant telescopes, huge databases and other expensive resources. As such, they have also significantly shaped future views of our universe.

Contribution ID: 1070

The Reconstruction of a Working Model of Heumgyeonggak-nu, Astronomical Clock

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Based on the literature of the Joseon Dynasty and a domestic and international artifact investigation, this study reconstructed a working model of *Heumgyeonggak-nu* of the Joseon Dynasty. *Heumgyeonggak-nu* was a decorative water clock designed by King Sejong in 1438 and first made by Jang Young-sil, which was installed in *Heumkyeonggak* Pavilion. *Heumkyeonggak* Pavilion was lost in two fires, but reconstructed and operated continuously for about 180 years. *Heumgyeonggak-nu*, which is shaped like a mountain towering over the plain, tells the time by making time-keeping puppets move on the mountain, foothill, and plain, and bang bell, drum, and gong. It can be seen that the water clock plays the role of 'an astronomical clock' by simulating the sun's diurnal and annular motion at the top of the mountain.
The reconstructed model of *Heumgyeonggak-nu* designed by this study allowed for rotational power generated by water wheel to be transmitted to the five layers of the mechanical. The constant-speed escapement of the water wheels was made with reference to a balancing lever developed in the Northern Song Dynasty of the early 11th century. In order to drive the time-keeping puppets with power transmitted to each layer, the bump, laver, ball, and transmission leg were made to be combined and operated organically. The reconstructed working model of *Heumgyeonggak-nu* has been installed and exhibited at the National Science Museum in Daejeon, Korea since September 2019.

Contribution ID: 1175

Eclipse in the 19th century Ottoman applied source

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In the Ottoman Empire, the prediction of an eclipse was calculated by official astronomers (munejjims) each year. Information such as eclipse magnitude and time was given in the taqwim (annual almanac)

and ahkâms (judgments).
The accuracy of the eclipse information contained in the almanacs shows that the almanacs are reliable. In this context, the Ulug Bey Zij comes up to be a source used by Ottoman astronomers for a long time in almanac calculations. On the other hand, the taqwim for the year 1213-4 (1798-9) was prepared using the Cassini Zîj. However, since the taqvims prepared with the Cassini Zij had a margin of error of up to 25 minutes in eclipses, this zij was abandoned, and the Lalande Zij started to be used in 1814 for more precise calculations. Following these astronomical charts, the almanac prepared by the Paris Observatory named Connaissance de temps in the 19th century began to be used. On the other hand, the yearbooks (sâlname) which differ in structure and content from the taqwim and judgments published by the Rasadhâne-i Amire, since 1872, are other sources that contain eclipse information.These developments are also important as they represent the entry of modern astronomy into the Ottoman scientific literature.
In this context, our study has two goals: The first is the analysis and comparative evaluation of the eclipse data contained in the abovementioned sources. The second is the determination and examination of the reflections of European based new contributions on eclipses in the history of Ottoman Astronomy.

Contribution ID: 1139
A Phylogenetic Appraisal of the Concept of Celestial SPHERE

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A phylogenetic approach to scientific concepts holds that concepts form a rational evolutionary lineage, which explains how the larger fields of science have emerged and demised consequently. This paper investigates a central concept in ancient astronomy, namely the concept of celestial SPHERE, with regards to its epistemic goals. If successful in our historical task, it should be clear why the concept is introduced in ancient Greek and not earlier in the Babylonian culture in response to a kinematic goal. Although the Greek concept was in a primitive shape carrying several ambiguities in terms of observational and philosophical conflicts, a heavy load of the literature is dedicated to this period and on whether the concept was used for a realistic or instrumental purpose. Thus, the rest of this story remained untouched. We will trace back the second piece of this puzzle in the golden age of Islamic astronomy, where the concept was articulated and associated with an absolutely dynamic understanding. Muslims stressed some conceptual components such as the uniform circular motion of the spheres. This led them to develop several non-Ptolemaic models, but with the cost of complexity of the models. The official statement of the concept's abandonment issued, not by Copernican heliocentric revolution but, by Kepler who was impressed by Tycho's observational evidence and exhausted from the complex models with several causal spheres. This insight makes SPHERE an interesting concept different from the concepts that were abandoned due to theory change.

Contribution ID: 1061
A Survey of the First Persian Book in Modern Astronomy in Iran: Masʿūd Anṣārī's A Summary of Astronomy (1819)

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This paper is based on correction and description of a treatise titled *Khulāsa az 'Ilm Hay'at* (*A Summary of Astronomy*) translated in 1819 by Mas'ūd ibn 'Abd al-Raḥīm Anṣārī (1791-1831) from French. The treatise is a textbook in new astronomy which, for the first time, introduced many concepts of modern astronomy -such as heliocentric world, Kepler's laws, gravity, etc.- to Iranian audience in Persian. Although Anṣārī did not mention his source, we found that his treatise is the translation of the last part of a French textbook entitled *Éléments de Physique Experimentale, de Chimie Et de Mineralogie, suivis d'un Abrégé d'Astronomie* written by Pierre Jacotot in 1804. This textbook was probably brought to Iran by Armand-Francois Lamy (1781-1839), a military advisor and a teacher of geometry in Iran around 1807. Examining the content of the treatise shows that the translator could find appropriate equivalents for many of modern astronomical terms by his little knowledge of Ptolemaic astronomy,although in some cases he failed.
Through some evidence, we may show that during the reign of Fatḥ'alīShāh Qājār, a military school was established in Tabriz by French military advisers who came to Iran following the Finckenstein Treaty. Anṣārī was among the young officers of the Viceroy Abbas Mirza Corps, who learned modern science and French at that school .As we'll see, one of the results of the formation of this school, was probably translating this modern astronomy book into Persian.

Symposium Science and Religion from an angle - ID 166

Contribution ID: 186
'Our English science': science and religion in an imperial context

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In 1872, the Canadian geologist John William Dawson gave a presidential address to the Natural History Society of Montreal, in which he expressed his hope that geology would 'sweep away the fabric of evolution, and restore our English science to the domain of common sense and sound induction'. For Dawson, science and religion were inextricably linked. Moreover, science was more than a discipline – it was a methodology based on the Baconian ideals of empiricism and induction. This methodology was fused with the Scottish school of Common Sense direct realism to create a comprehensive epistemology that would allow a scientific understanding of the Bible and the natural world. As the use of 'our English science' suggested, this approach was bound up in Britain's sense of national, and indeed imperial, identity, as the scientific method was held to be responsible for Britain's technological, commercial, and imperial pre-eminence. This paper examines this relationship by exploring how debates about science and religion were interpreted in the British imperial context. It demonstrates that this understanding of science provided a common context for metropolitan, regional, and colonial actors. It also demonstrates that threats to Britain's imperial ambitions were considered more serious than the any putative conflict between science and religion, using examples such as the Irish Home Rule crisis, which erstwhile

opponent John Tyndall and William Thomson combined forces to oppose, and the threat of the German Empire.

Contribution ID: 229

Catholics and national identity in modern Germany

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*Wissenschaft*or systematic research science, especially as it pertained to the study of nature, was far more than a method of knowing in Germany's "long nineteenth century." Because it defined the intellectual values of middle-class elites, it was also a code that regulated status as Germans struggled to create a durable national community: embracing *Wissenschaft*was a sign of commitment to the nation's progress and therefore a badge of belonging; resisting *Wissenschaft*justified social exclusion on grounds of national unreliability.
This code placed Catholics in a difficult position. While they were keenly interested in natural science, their approach to science did not meet the standards set forth by the secularizing captains of *Wissenschaft*. They continued to cherish their belief in divine hip of life and to assert nature's providential aims. They also held firmly to the principle that God might suspend nature's laws in miracle. For these beliefs, Catholics learned that they were unsuited to national participation.
My paper explores the dynamics of their exclusion on the basis of clerical and lay records from the nineteenth century. For Catholics, this exclusion was a source of abiding pain, because they knew that their tradition provided for the study of nature, even in its empirical and reductive forms.

Contribution ID: 1312

Darwin's Greek ancestors: Evolution, communism and nationalism in Greece (1880-1940)

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Darwinian evolution and Marxist thought have a long and tumultuous common history. From Marx's 1860 'Darwin contains the basis for our views in natural history' to his 1862 'natural selection is the application of the Victorian social model to nature', there has been an ambivalence about how much Darwinism enabled or opposed Marxism. This creative tension took on a new role in late 19th century and early to mid- century Greece. Darwinian evolution sparked controversies in Greece before Marxism and communism appeared. However, by the time that a robust communist party had appeared in Greece by the 1930s, Darwinian evolution had become a symbol for communists and anticommunists alike, in their intellectual war over materialism. This paper wants to untangle the various ways Darwinian evolution was perceived, used or attacked by conservatives and radicals in Greece. At the same time, it aims to show how Darwinian thought was implicated on the ongoing debate about patriotism and nationalism in early 20th century Greece.

Symposium (Part 1/3) Science and literature in small and large scales (Commission on Science and Literature) - ID 248

Contribution ID: 722

'A Lord of the Rings-type world': J.R.R. Tolkien and the paleoanthropological imagination

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This paper will examine the role of one of the twentieth-century's most famous creators of giants and dwarves in shaping palaeoanthropology. Since the release of Peter Jackson's film of *The Fellowship of the Ring* in 2001, references to what J.R.R. Tolkien called his *legendarium* have become increasingly common in discussions of human evolution. In 2004 the Australian paleoanthropologist Mike Morwood proposed naming a new species of extinct human discovered on the island of Flores in Indonesia *Homo hobbitus*. Morwood's proposal was overruled, but the 'hobbit' caught on and has remained the ubiquitous nickname for *Homo floresiensis*. Like Morwood, other paleoanthropologists have found themselves conceiving of the evolutionary landscape of early humans in terms derived from Tolkien. Evolutionary geneticist Mark Thomas has characterised recent research as showing that our ancestors lived in 'a Lord of the Rings-type world'. Neanderthal expert Clive Finlayson likewise identifies the geographical range of human evolution in Africa and Eurasia as 'Middle Earth'. In this paper I will suggest that Tolkien's fiction has influenced not only how scientists communicate the science of human evolution but also how they conceive of the relations between different kinds of human being in the distant past. While the first half of the paper will expand on these examples where paleoanthropologists reference Tolkien directly, in the second half I will turn to the latent effects of Tolkien's imagination on how we might come to understand human evolution and how that understanding bears on our reading of Tolkien's fiction itself.

Contribution ID: 999

'To discerne the Lyon by his paw' – Imitation and plagiarism in early modern English science

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This paper focuses on two cases of apparent plagiarism in seventeenth-century England. The figure whose works had supposedly been plagiarised was Edward Gresham (1565–1613), an English mathematician and almanac-maker, the author of an astronomical treatise *Astrostereon* (1603). Gresham's symbols were purportedly copied by Thomas Bretnor (1570/1–1618) in one of his Prognostications – a slander which he was trying to refute in a letter to the reader in 1612. For most of the seventeenth century, Gresham had been habitually recalled as a Papist (for his alleged participation in the Gunpowder Plot) and a conjuror (for his involvement in the so-called Overbury affair). However, in a long *bataille* with William Lilly (1602–1681), John Gadbury (1627–1704) rehabilitated Gresham and ardently presented him as an ingenious author of the treatise on the conjunction of Saturn and Jupiter in 1603, a text Gadbury once saw in manuscript, and which he believed was blatantly plagiarised in

Lilly's *England's Prophetical Merlin* (1644). Although at first those two instances seem peculiar and unrelated, they tell us a lot about how the notions of plagiarism and imitation were dealt with in the world of early modern English science – a topic which requires some more attention, especially in light of early modern theories of rhetoric and *mimesis*. What is more, I will also briefly present how both Bretnor and Gadbury resourced Gresham's *Astrostereon* whose contents shed some new light on Gadbury's accusations of Lilly, hitherto believed as definitely countered by the intervention of Elias Ashmole (1617–1692).

Contribution ID: 1009

Illustrated scientific instruments books in late Qing: popular science, social fashion and trade

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Between 1880 and 1892, The Chinese Scientific and Industrial Magazine successively published "Gezhi shisi" (Explanation of Scientific Instruments) in 10 volumes. The volumes are "Cehou Qi" (Meteorology Instruments), "Huaxue Qi"(Chemistry Instruments), "Zhongxue Qi" (Mechanics Instruments), "Jingshuixue Qi" (*Hydrostatics* Instruments), "*Dongshuixue* Qi" *(Hydrodynamics* Instruments), "Qixue Qi" (Pneumatics Instruments), "Zhaoxiang Shuo" (Photography instruments), "Xianweijing" (Microscope Instruments), "Yuanjing Shuo" (Telescope Instruments), and "Cehui Qi" (Surveying and Drawing Instruments). These ten illustrated instrument books compose the most systematic and available of the translations of Western scientific works in the late Qing. They reflect the demand for chemical analysis in the mining of iron and coal in the Self-Strengthening Movement. This paper will first research the compilation background, motivation and purpose of "Gezhi shisi", and study the Western original versions of the ten illustrated books, and clarify the significance and academic value of their history of scientific development in the late Qing. In the Self-Strengthening Movement, the government of the Qing mainly pursued Western military technology, and mostly ignored the introduction of basic science. Therefore, these illustrated instrument books show that the importance of establishing basic scientific knowledge in the late Qing Dynasty is also part of our study. These books containing instructions for the use of the instrument and the price chart naturally become a catalogue of instruments sold by Western instrument companies or traders. They represent the most realistic side of scientific development in the late Qing. How to identify these invisible scientific infrastructures, therefore, is also the point of our paper.

Session II (Part 1/3) - Biological Sciences - History of Zoology

Contribution ID: 1204

A global history of zoos in the long nineteenth century

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The zoological garden is a child of the nineteenth century. Starting off as a Western European phenomenon it soon spread around the globe. By the 1890s there were zoos on every continent. From

the very beginning these institutions were very much aware of one another, not only of their existence but of their specific challenges (in particular how to keep exotic animals alive).
This paper will try to apply new approaches from global history to the history of the zoo. It will attempt to trace „the rise of global *uniformities*" (Bayly) with respect to how zoos were built, organized and used by its diverse publics, ranging from naturalists, acclimatizers, animal traders, educators and the general public and in particular how the animals were presented. At the same time, taking into account the specific local contexts of each zoo, this paper will ask for the idiosyncrasies of individual zoos. How can these two perspectives be combined? In what way is it possible to talk about the zoos of Antwerp, Buenos Aires, Cairo, Calcutta, Philadelphia and Perth in a coherent and fruitful manner?
The solution proposed by this paper is to conceive of the nineteenth century zoo as a large network in which knowledge but also animals and people circulated. The hybridity of the institution itself (torn between a scientific research agenda and the need to provide a spectacle), asymmetries in power and resources as well as the omnipresent colonial context will have to be taken into account.

Contribution ID: 1130

In multis una: Professionalization of wildlife zootechnics as a scientific practice in the zoological gardens' system of Mexico City

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The documents gathered here are a testimony of characters like Alfonso L. Herrera, Miguel Ángel de Quevedo, Manuel Cabrera and Fernando Gual, whose influence on zoological institutions in Mexico City guided their development, both for their material legacy and for their memories and views. This process can be traced by the practice of wildlife zootechnics that generated situated knowledge, linked to a research agenda directed by the political paths of Mexico City. The inauguration of Chapultepec Zoo (1923), located in the western part of the city, was related to the democratization of public spaces as a monument to nature by the post-revolutionary governments, and, after having a federal administration, it joined the municipal services through the Federal District Department (1938), where the Zoological Gardens System (ZGS) was expanded with the San Juan de Aragón Zoo (1964), to the north-east, and to the south with the Tlalpan Forest Zoo (1970), but with the return of democratically elected governments for Mexico City (1997), the Tlalpan Forest ceased to function as a zoo, while the Los Coyotes Zoo was rehabilitated (1999). Altogether, the testimonies traced from 1896, 1934, 1970 and 2006 offer an overview of the almost centennial public and scientific education carried out in the ZGS, where the results of the professionalization of wildlife zootechnics justify the shift towards an integrated conservation agenda, that is, an agenda under the bioethical parameters for the conservation of biodiversity and animal welfare.

Contribution ID: 1163

May the peripheries lead us to the center: interwar Japanese zoology in Micronesia

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In June 1915, zoologist Okada Yaichirō headed to the Micronesian islands aboard Imperial Japanese Navy's *Kagoshima-maru*. The twenty-six year old recent graduate of the Agricultural Ministry Fisheries Training School was accompanying his mentor, Tokyo Imperial University (Tōdai) Professor Gotō Seitarō. A year after Japan had occupied German Micronesia as a trophy for its intervention in the Great War, the government had tasked Gotō to conduct zoological research on the islands. Gotō was one of the first generation of Japanese scientists who studied zoology at Tōdai from American- and German-educated Japanese teachers, and himself had studied in the *fin-de-siècle* U.S. He replaced one of his Tōdai teachers at his passing at the research center of the empire. By the 1910s, such an opportunity was becoming rare with chairs of major institutions occupied, and with five Imperial Universities churning out ambitious graduates. Government interest in commercial zoology remained, but so did academic zoology's preoccupation with observational methodology while its counterparts in the U.S. and Europe had long shifted to experimental science. In this seeming impasse, young zoologists like Okada welcomed the fieldwork experience in the empire's peripheries, which might give them the edge to one day becoming giants of the field. This paper explores these interwar zoologists who eyed Micronesia as their opportunity, just as the 1880s/90s entrepreneurs looked to uninhabited islands to the south of the archipelago as sources for their albatross fortunes, and the experiences in the wartime Palao Tropical Biological Station would later catapult young Japanese scientists' careers.

Symposium Re-imagining imaginaries. Rethinking our stories - ID 431

Contribution ID: 701

Aircrafts, ships and satellites. Space sciences as field sciences

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History of space technology has been depicted predominantly as made up of (usually American-centred) turning points in rocketry, space exploration or human space flight: techno-bureaucratic Big Science products embedded in Cold War military, prestige and nation-building objectives.
While this dominant representation is useful to understand many developments of the so-called space age history, it has tended to downplay the role of natural historical practices of data collection and interpretation in conceiving remote-sensing satellites. This paper argues that, even if the development of satellite remote-sensing programs, and the practical use of the data generated with them, adopted many features of the organizational culture typical from Big, space, laboratory, Cold War science, the tradition of field sciences was also a crucial feature to practices and visions of satellite remote-sensing work -and this tie remains strong today.
By focusing on the role of aerial photography in the development of remote-sensing satellite technology between 1967 and 1973 in France, this paper situates its history at the crossroad between space science and the tradition of field sciences. It examines who first invested professionally in remote-sensing, what they brought with them, what they did (or failed to do) with it, and how. It illustrates that there are more motivations, tempos, people and practices involved in space technology than commonly imagined. If we wish to understand the interplay between science and technology and our societies, we must pay attention to all of them.

Contribution ID: 829

Human technologies and social policy: alternative sociotechnical imaginaries of mindfulness in the UK

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The Mindfulness All-Party Parliamentary Group (MAPPG) considers the role of mindfulness meditation within UK social policy. In 2015 MAPPG's landmark report *Mindful Nation* argued for the increasing use of meditation technologies in the domains of health, education, the workplace and the criminal justice system. *Mindful Nation* acknowledged that the scientific evidence supporting the proliferation of mindfulness remained patchy. But it argued that this form of meditation could prepare the UK population for longer and less stable working lives. The pursuit of social policy goals has contributed to the creation of alternative imaginaries for meditation technologies. This article explores the backdrop to the competing understandings of meditation as it transitioned from a mystical practice to a medico-scientific intervention.

Contribution ID: 864

Health diplomats and scientific experts on the verge of contagious breakdowns

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In this paper we analyse the strategies developed since the nineteenth century when in the so-called International Sanitary Conferences medical practitioners, bacteriologists, and diplomats of European powers join forces to address the problems that cholera epidemics caused to colonial trade and international travel. Since the 1890s with the advent of the telegraph and the political mediation of Austro-Hungarian diplomats to mitigate imperial aims of the UK and France, a diplomatic agreement to put in place a European surveillance system of epidemiological surveillance was reached. It served the aim of notifying and regulating maritime traffic of European powers and its impact on the spread of contagious diseases. Since then, the number of epidemiological systems for the tracking of communicable diseases have raised, and scientific disciplines such as epidemiology, organic chemistry, bacteriology, and microbiology have acquired high relevance for programmes of national security and to fulfil geopolitical aims. In parallel to the development of scientific disciplines aforementioned, science and technology have allowed both the understanding and the manipulation of the microbial life that have underpinned planetary dynamics such as postwar Great Acceleration and modern industrialization. As we show in this paper, health crises like the COVID-19 pandemic that we are experiencing since early 2020 are often accompanied by rising tensions among mighty political powers. We therefore inquire the disruption of sanitary equilibria as both the effect and the cause of rising international political tensions. In addressing such inquiry, we scrutinise the ways in which politicians, diplomats and scientific expertise have mingled to handle sanitary issues, and how political and diplomatic crises have pulled scientific experts in losing their credibility.

Contribution ID: 872

The Frankenstein complex: historical imaginaries of cybernetics and cyborgs, and contemporary imaginaries of artificial intelligence and robots

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Isaac Asimov's robot stories and 'laws' of robotics were acts of cultural intervention. Asimov used science fiction as cybernetics agitprop to defy what he termed the "Frankenstein Complex". He was correct about the existence of the complex, and wrong in his reduction of it to Luddism and in his acceptance of the received history of the Luddites as mindless and mobbish wreckers of technology. The Frankenstein Complex is rooted in the Judeo-Christian belief system, especially the myths of the creation and the fall, and tracks back to Christianity's assimilation of the pantheisms of classical Greece and Rome. Shelly's Frankenstein re-commits the original sin; disobedience of God in pursuit of forbidden knowledge. He further transgresses by commission of hubris; daring to imbue the inanimate clay with divine fire. In mortal hands the sacred spark begets a grotesque creature. A parody of life. A golem. A mocking simulacrum cast out even by its creator. A monster doomed to enact divine retribution and destroy his father. We stand on the brink of the inception of non-human cognitive entities with autonomous agency in our worlds. What was once only fictive is now corporeally embodied. This paper will trace the emergence of the Frankenstein Complex in the historical discourse around Cybernetics and outline the manifestation of the Frankenstein Complex in contemporary cultural, academic, intellectual, political and legal treatments of AI and robots. And, address the question: is it God's will or ours that we shall be cast down by the creatures of our own making?

Session III (Part 1/3) - Geography

Contribution ID: 1254

Giants and dwarfs among geographical societies in the "long" 19th century

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Between 1821 and 1914, up to 170 "geographical societies" were founded in all inhabited continents. They worked to promote and disseminate geographical knowledge, and were geography's institutional basis before university chairs of that discipline began to emerge in the late 19th century. The three oldest geographical societies were, in some respects, also the most famous and influential: Paris (founded 1821), Berlin (1828), and London (1830). Many of those founded later were located in "provincial" cities, or "peripheral" countries. On the other hand, the oldest societies, which also have received the most attention from historians, did not necessarily have the most members, or the most money, etc. In an ongoing research project, my colleagues and I seek to draw comparisons and identify connections among the world's geographical societies in the "long" 19th century. In my contribution to the congress, I will examine "giants" and "dwarfs" among those institutions as well as among their individual members and guests. In which respects was a geographical society "big" or "small"? How did this affect its activities as well as its relations with other, "bigger" or "smaller" societies? Moreover, certain societies were founded and/or led and/or visited by eminent if not world-famous geographers or explorers. What role did those "giants" play for the societies – or, conversely, how much of their status did the "giants" owe to "their" societies? And what did it mean for smaller geographical societies if they did or did not have "giants" of their own?

Contribution ID: 1107

The Role of Academician F.N. Chernyshev (1856-1914) in the Research of the Arctic

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Currently, the historical experience of the world science in the development of the Arctic is of great interest for research due to the crucial role of the Arctic region in the international geopolitical space. Dedicated work of travelers and scientists from various countries of the world made possible the discovery and study of these climatically harsh territories.
The Russian geologist, academician F.N. Chernyshev (1856-1914) was one of the scientists who devoted most of his scientific career to the study of the European North and the Arctic. He became one of the initiators of Arctic scientific research in Russia at the turn of the 19th and 20th centuries. The main tasks of the research were the study of the Arctic climate, which affects the whole world, and the identification of resources needed for industry.
Thanks to his high authority, three large-scale research activities were organized under his leadership: the Timan expedition (1899–1890), the Novaya Zemlya expedition (1895), and the International Russian-Swedish expedition on grade measurements on the polar archipelago of Spitsbergen (the Svalbard archipelago, 1899–1901). The tasks of the expeditions included geological exploration of completely unexplored vast areas of the European North of Russia and the Arctic. As a result of these expeditions, new unique data on the geography and geology of the surveyed areas were collected. The research conducted by F.N. Chernyshev showed the resource potential of these territories and became an important factor for their further development.

Contribution ID: 1002

Ez ikusi, ez ikasi ("do not see, do not learn"). The scientific adventure of a polymathic savant: Antoine D'abbadie

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The purpose of this paper is to present some of the main contributions of the Basque scientist Antoine d'Abbadie (1810-1897). Although nowadays his figure has been partially forgotten, his immense work in numerous fields of knowledge, such as geography, ethnology, linguistics, physics or astronomy, allows us to recognize a fascinating figure within the nineteenth century European scientific community (which led him to occupy the presidency of the French Royal Academy of Science and the Geographical Society of Paris). His wide horizon of scientific concerns leads him to undertake, for instance, one of the most exciting explorations of that period: the search for the sources of the Nile. But his activity also included mapping two hundred and fifty thousand kilometres of the territory of Abyssinia, carrying out ingenious experiments, making thousands of astronomical observations during his travels around the world (namely, Brazil, Norway, Greece, Haiti, Algeria, Upper Egypt ...) or in his own home, a picturesque Gothic castle he built in Hendaye (where he located a meridian telescope and a high concrete tower to study the effects of micro-earthquakes over the earth's crust and to achieve the objective of cataloguing

half a million stars), elaborating the first dictionary of the Amharic language, promoting European Orientalism or revitalizing the ancient Basque culture (hence his famous nickname as "father of the Basques"). In this way, Antoine d'Abbadie represents, driven by his insatiable curiosity and his polymathic genius, a style of making science in which a philosophical and humanistic vision of life is glimpsed.

Contribution ID: 1073

"L'uomo e le scimie": Filippo De Filippi between evolution, expeditions, and science popularization

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The Italian zoologist Filippo De Filippi (1814-1867) played a key role in 19th century natural history. After the degree at the University of Pavia, in 1840 he was appointed as assistant to the director of the Museum of natural History of Milan, where he managed the zoological collections, worked on scientific papers and held some popular science courses. The fundamental turning point in his life took place in 1847, when he was appointed as professor of Zoology at the University of Turin and director of the Zoological Museum. In Turin, De Filippi stood out as the most influential Italian zoologist at the middle of the 19th Century and continued and improved his activities as zoologist, professor, museum curator, popularizer. He is known for his role in introducing the Darwinism in Italy in a public lecture in 1864, entitled "L'uomo e le scimie", in which he, for the first time in Italy, took a position for the theory of evolution, also about the human being. After a scientific mission in Persia (1862), De Filippi was appointed scientific director in the expedition around the world of the Italian corvette "Magenta" (1865-1868). During the voyage, he died in Hong-Kong in 1867. De Filippi represents an interesting figure of naturalist, involved in the diffusion of darwinism in the Italian context, able to conjugate the rigorous scientist with the devout man, coniugating evolution and faith; moreover, he worked in several different fields: university, museum, popularization of science, expeditions.

Contribution ID: 1067

"Leaving some wiggle room" and "pursuing cooperation": the China-US scientific and technological exchanges on earthquake prediction during 1971-1979

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In the process of China-US relations' normalization, scientific and technological exchanges came first and played an important role in promoting the bilateral relations and also was restricted by the relations. Given the disparity in the level of science and technology between China and the US, earthquake prediction was one of the few areas in which both sides had their own strengths, and had become a highlight of China-US scientific and technological exchanges. Because of the lacking of formal diplomatic relations and confidentiality restriction, the exchanges between the Chinese and American seismological communities had been hampered, and the attitudes of the two sides were also completely different. While actively engaged in exchanges, the American were pursuing cooperation in earthquake science and technology. However, the Chinese had always adhered to the principle of "propagating

actively, no boasting, and leaving some wiggle room", and only engaged in scientific and technological exchanges and refused to formally cooperate. This article attempts to analyze the details of China-US exchanges on earthquake prediction and reflects the complicated interrelationships between scholarly exchanges and politics, diplomacy.

Symposium (Part 1/3) The Greek and medieval Ptolemy (CHAMA) - ID 91

Contribution ID: 331
Theodosius' /Spherics/ and Ptolemy's spherical astronomy

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In his Almagest, Ptolemy develops spherical astronomy as a computational practice on the basis of the Sector Theorem, and sets out his results in tables that he explains can be used to compute various stellar and solar phenomena. In the process of this development he relies on a number of theorems that can now be found in the Spherics of Theodosius. In this talk, I will discuss a number of theorems in which Theodosius treats topics of spherical astronomy and explore their relationships with the material in the Almagest.

Contribution ID: 156
Ptolemaeus Arabus et Latinus in 2021: achievements and outlook

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This paper presents the main results achieved by the project Ptolemaeus Arabus et Latinus since its beginning in 2013. Emphasis will be placed on the online database (https://ptolemaeus.badw.de), which offers a catalogue of Ptolemaic works, manuscripts and early printed editions; access to images and texts; and a glossary of Greek-Arabic-Latin-English technical terms.

Contribution ID: 111
The dissolution of the carrying sphere in Ptolemy's Planetary Hypotheses and its reception in the medieval Arabic tradition

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The renunciation of solid celestial spheres, in which the stars and planets are fixed and thus carried around, is rightfully connected with Tycho Brahe and Johannes Kepler. However, also Ptolemy made a first cautious step in this direction. When he argued in the *Planetary Hypotheses* that celestial motion is

caused by souls, he considers the possibility (without explicitly adopting it) that also the planets have a voluntary motion by their own souls. In that case, Ptolemy argues, one could get rid of the very last sphere that actually carries the planet, since the planet is not fixed on this sphere any more, but has a single motion by itself. Nevertheless, this freely moving planet is embedded in a certain number of spheres in order to account for the complex planetary motions, and in this respect Ptolemy is still far away from the cosmology of Brahe or Kepler.
Ptolemy remains rather vague about the consequences of this suggestion. The examples of Ibn al-Haytham and Avicenna show that the Arabic tradition has been aware of this suggestion. Both of them argue against this theory on the basis of arguments drawn from natural philosophy in the tradition of Aristotle.

Contribution ID: 134
Traces of the unrevised translation of the Almagest by Isḥāq ibn Ḥunayn

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As the most influential work on geocentric cosmology, Ptolemy's *Almagest* received much attention by medieval astronomers. According to medieval Islamic sources, the *Almagest* was translated into Arabic several times. The most widely distributed translation was made by Isḥāq ibn Ḥunayn (d. 298/910) and then revised by Thābit ibn Qurra (d. 288/901). In the course of collating the ten available manuscripts of the Isḥāq-Thābit version, considerable differences between two very similar copies (one of which was copied from the other) and the eight remaining ones became apparent. Since these differences in particular concern the terminology and the structure of sentences, they cannot be the result of scribal mistakes. Therefore, we may distinguish two groups of manuscripts of the Isḥāq-Thābit version. A detailed comparison between the differences between these two groups points to improvements in the process of translation that could be the result of an extensive revision. Therefore I consider these two groups not as two families of manuscripts of the same work, but as two different translations. Taking some marginal notes in the manuscripts into account, one of the groups may render Isḥāq's original translation (which was hitherto thought to be lost) and the other contains copies of Isḥāq's translation revised by Thābit. Based on this hypothesis and comparing the two translations with the corresponding original Greek text of the *Almagest*, some ideas may be developed about the process of translation and revision in the Greco-Arabic translation movement in medieval Islam.

Symposium (1/7) 16th Annual Symposium of the Social History of Military Technology (ICOHTEC) - ID 124

Contribution ID: 985
Collaborating hands: artisan, scholar, and the techniques of prototyping in 17th-century Korea

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This paper investigates the collaboration of artisans and scholars in the making of a new military technology in 17th century Korea. In particular, it examines the invention of the Korean wheellock landmine—derived from a Chinese design—by artisan Cho Ch'ŏnjong (fl. 1592) and his scholar-patron Yi Hyŏn (1540–1618). This study is based on the newly discovered literati compilation by Yi, which contains descriptions of their collaboration as well as Cho's drawing (modified by the scholar) of the landmine. More broadly, however, this study also contributes to our understanding of early modern science and technology. Namely, historians such as Pamela H. Smith, Pamela O. Long, Lissa Roberts, Simon Schaffer, and Peter Dear have emphasized the materiality of knowledge production, or the "handy mind," in the birth of new sciences and technology. Questions linger, however, as to how this convergence took place and to what extent it transpired (or not) in other cultures. I advance this field by introducing the important yet neglected case of Korea, and specifically, the local concept of prototyping (*kyŏnyang*)—i.e., the use of drawings, models, and measurements to capture a technical design. This knowledge practice was not only the primary mode through which Cho and Yi collaborated; it was a widespread technique that developed in the military workshops of Korea—between the artisans who took a practical, hands-on approach to production and their scholar-supervisors who held generalist knowledge about crafts.

Session IV Engineering

Contribution ID: 1037

Capturing the dead: spirits, photography and the revival of the occult in Republican China (1912–1949)

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On 28 February 1918, the Shanghai Spiritualist Society received an apparently recent photograph of Xu Banhou, which sparked a furore in the Chinese press. The shock was caused not by Xu's eminence as a member of the former Imperial Academy, but because he had died three months earlier, victim of a shipwreck. Just eight days before the Society received Xu's photograph, one of its main spirits had stated through a seance that photographs of spirits could be taken only by those who possessed a sincere heart, the wisdom of spiritualism and the knowledge of photography.
The incident triggered the production of a series of photographs of spiritual beings, marking the beginnings of spirit photography in Republican China. The technique was already well known in the United States and Europe, and it gained a new lease of life in Japan after Fukurai Tomikichi developed "thoughtography", a method for projecting mental images onto photographic film. Debates about the veracity and utility of spirit photography permeated the Chinese press, raising questions about the reality of the spirit world and its relevance to a modernising nation.
Looking at the introduction of spirit photography into China through a transnational perspective, this presentation will investigate its popularisation among reform-minded elites during the hypnosis craze that swept across the country. Through a series of case studies, it will challenge mainstream assumptions that conceive modernity as a single force running toward secularisation by clarifying how

science and technology legitimised, rather than undermined, religious experience in early twentieth-century China.

Contribution ID: 1100

"Last hired, first fired": systemic racism and the enduring dearth of diversity in the cockpit

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Six decades after a 1963 U.S. Supreme Court decision forced airlines to end de jure racist hiring policies, less than three percent of commercial pilots are African American. My current project, *Flying While Black*, represents the first scholarly book by a historian to examine the long, slow, and incomplete process of racial integration of the airline cockpit in the United States. Grounded in printed, archival, and oral history sources, my research illuminates the practical and cultural barriers that stood between African Americans and this high-paying, high-status, high-tech career from World War II to the present. This paper focuses on the first generation of Black airline pilots, who in 1978—fifteen years after the aforementioned Supreme Court decision—represented just 0.25 percent of the workforce. These pioneers were at once giants, serving as "symbols of possibility" for the African American community, while in their day-to-day reality they remained dwarfed by the overwhelmingly white male workforce that dominated the cockpit and company management. Analyzing their backgrounds and experiences reveals how ostensibly race-neutral job qualifications remained a barrier for other prospective Black pilots and helps explain the continued lack of diversity in the cockpit. Although this case study focuses on a segment of one industry, it promises to provide new insight into the deep-rooted obstacles that hinder racial diversity in other STEM-related fields including engineering, medicine, and the sciences. By sharing my work with ICHST members, I look forward to receiving valuable feedback that will inform me as I finish this book.

Contribution ID: 1278

Giant challenge – dwarf solution: re-invention of the wheel in the Russian hinterland

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The paper presents an alternative view of the recent history of mastering Russian roadlessness. By exploring local solutions to the countrywide challenge of being mobile, we documented and described a new class of small-size all-terrain vehicles invented in the early 1960s and still used by inhabitants of the Russian hinterland – widespread over the territory of the former Soviet Union. These all-terrain vehicles are distinguished from other ATVs because of the combination of large-volume low-pressure wheels and lightweight body that ensure no damage on the fragile surface and provide low fuel consumption. They are not hobby or contest machines, such as mud racing, rock climbing or monster cars, but humble mostly self-built vehicles used for fishing, hunting or mushroom- and berry-picking trips, and visiting neighbours. We combine historical analysis and ethnographic observations to trace the history of the

"re-invention of the wheel" and present how the "giant" issues of territorial distance, isolation, and lack of proper infrastructure can be successfully overcome with "dwarfy" locally appropriate technology.

Contribution ID: 1266

Finding the right engineer: the process of selecting technicians to work in France, 1944-1950

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In 1945, French military and industrial planners discussed the process of catching up technologically by recruiting German technicians to work in France for a determined period. While the use of such labor in France's resurgent aerospace technology is broadly understood, this paper relies on archives recently opened to suggest that the stand-alone myth surrounding France's economic boom is exaggerated.
While the recovery and shortcomings of French technology in the time of the Fourth Republic (1944-1958) are well understood, a shadow looms over the role of German scientists and engineers in bringing all fields up to speed. While rocket engineers were recruited to help create the French ballistic missile agency, under the guidance of French intelligence a "shopping trip" of sorts did occur.
In some cases, French intelligence sought people directly in the American and Soviet zones of occupation, while in others, the Germans recruited were given preferential treatment for lodging and food in France (at a time when most of the German and French populations relied on food stamps). Paradoxically, the kind of field expertise sought evolved from military-oriented ones to such civilian ones as mirror or button manufacturing. By the late 1950s, most of the German engineers involved (estimates range as high as 1,500) had either returned home of migrated to other countries, but the process of their involbvement had indeed contributed to French industrial recovery.

Symposium Epidemic histories in Southeast Asia (Pacific Circle) - ID 104

Contribution ID: 853

The sciences of disease prevention and the regulation of mobility in the Dutch East Indies (Indonesia)

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Often, measures to prevent or reduce the spreading of epidemics have included the regulation and limitation of mobility. This can take the form of quarantine, sealing off areas, and prohibiting travel. These measures have been controversial because they tend to interfere with commerce and freedom of movement. In the Dutch East Indies, measures to regulate mobility were unevenly applied to the European and indigenous populations. Europeans arriving on a ship with a yellow flag (indicating infectious disease on board) were generally free to return home; they had to deposit a fee which would be returned to them after they visited a physician. This fee was unaffordable to most Indonesians. The annual haj (pilgrimage) to Mecca was severely restricted because it was feared that it played a central

role in the transmission of cholera from Southeast Asia to Europe. Both in the Dutch East Indies and *en route* to Mecca there were several quarantine stations where pilgrims were expected to disembark.
In my presentation, I will discuss the ways in which mobility was regulated in response to epidemic disease in the Dutch East Indies.

Contribution ID: 816
Missions of mercy: trade routes and the dispersion of vaccination for smallpox in Southeast Asia

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For at least a thousand before the World Health Organization declared smallpox eradicated in 1980 this dread disease affected not only the physical health of individuals but the economic health of entire communities in East and Southeast Asia. Ship's captains avoided ports where smallpox was active, at times ships with smallpox patients were sent back to sea by frightened communities, and when maritime communities were hard hit by smallpox economic life virtually ground to a halt. The economic disruption caused by smallpox in European empires and for European merchants inspired British, French and Spanish efforts to distribute smallpox vaccine in Southeast during the very early years of the nineteenth century. Because of these efforts vaccine and training in vaccination arrived in three widely separate ports, Batavia, Manila, and Penang within months of each other. Due to the medical parameters of vaccination as practiced at that time vaccinators depended on local citizens who volunteered their children to be carriers of vaccine to other communities. They also depended on local shipping networks, especially on ship's captains who were willing to time their travels to the needs of vaccinators. For nearly one hundred years after the arrival of vaccine it was repeatedly lost and repeatedly reintroduced and always it traveled over established trade routes on ordinary trading ships willing to take vaccine, vaccinators, and child-carriers of vaccine to their destination. This essay will examine the movement of vaccine from the ports first furnished with vaccine to other parts of Southeast Asia.

Contribution ID: 765
Epidemic Invasions in the Democratic Republic of Vietnam

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During a summer day in 1952, Vietnamese farmers in the Red River Delta may have looked up to see a French airplane dropping insects, powders, and other strange things. Or they may not have. In a now largely forgotten episode of the First Indochina War (1946-1954), the anti-colonial Viet Minh charged the French with the use of biological weapons. In order to combat germ warfare, the Viet Minh formed the Committee to Prevent Germs. This committee include high-ranking political officials of the Democratic Republic of Vietnam (DRV) as well as members from the ministries of health and of agriculture. It sought to substantiate the charges of biological warfare and determine appropriate counter measures.

If we view epidemics as a "sampling device" to understand things about society, then whether or not the French military conducted biological warfare matters less than the Vietnamese responses for the

purposes of our panel. Examining this potential germ warfare, we see that DRV medical doctors initially drew on traditions of dealing with natural disasters. In the meantime, they gathered as much information as they could and looked to China, and its experience with biological warfare during the Korean War, for guidance. They also sought to manage popular reaction. While at first peasants dutifully reported suspected germ warfare, when nothing happened, enthusiasm for such tasks waned. By the end of the First Indochina War, charges of germ warfare were quietly shelved, though never resolved, as they would resurface during the American War.

Symposium (Part 2/2) Giants and dwarfs in the transformations of mathematics in the XVIII century - ID 357

Contribution ID: 354
Mixed and applied mathematics in 18th century Prague

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During the 18th century, several attempts were made to reform education in the Habsburg empire in order to transform schools from classical institutions based on the Jesuit curriculum to centers of dissemination of scientific and technological advances.
One of the crucial targets of these reforms was mathematics. Throughout the 18th century, the teaching of mathematics was still part of the philosophical faculty and was taught to undergraduates, although it underwent a process of specialization. For instance, from 1775, the course of elementary mathematics was divided into two courses: one of "pure" and another one of "mixed" (*mixta*), which was later called with the German word "*angewandte*" ("applied") mathematics.
The aim of this talk is to study how the content, goals, and methods of the courses of "mixed" and "applied mathematics" at Prague university evolved during the second half of the 18th century in connection with to the new demands posed by the technical and industrial development of the state, such as the creation of engineers and civil servants, and how the knowledge of "modern mathematics", i.e. calculus with its applications to physical sciences, was assimilated and integrated into this discipline during the period. In the first part of this talk, I shall examine textbooks circulating in Prague, written both by the Bohemian teachers, such as S. Vydra (1741-1804) and by foreign ones, such as A. G. Kästner (1719-1800). Secondly, I will study related materials, such as dissertations and exams taken by students during the second half of the 18th century.

Contribution ID: 689
A recently discovered text by Bolzano

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This is the story of a book, a manuscript and a recently discovered text by Bernard Bolzano. Entitled Beyträge zu einer begründeteren Darstellung der Mathematik (1810), Bolzano's second published mathematical work was meant to be the first in a series and to usher in "a new epoch" in mathematics. However, disappointed by its reception, he announced 7 years later his decision to postpone the publication of any further instalment of his "contributions", the 1810 volume being the sole one he ever published.
Precisely, among a group of 5 manuscripts currently preserved at the Literární archiv Památníku národního písemnictví, 4 of which consist of transcriptions of reviews about Bolzano's 1810 book and his 1804 Betrachtungen über einige Gegenstände der Elementargeometrie, there is a manuscript that does not contain the reference to the original transcribed text. In this talk we will present a recently discovered text by Bolzano which not only completes the information available until now about such manuscript, but also sheds light on his Beyträge.
The speaker wants to acknowledge Steve Russ, Edgar Morscher, Wolfgang Künne and Davide Crippa for their helpful remarks and suggestions for the paper on which this talk is based.

Contribution ID: 927
Foundations in service of education: calculus textbooks in 18th century Prague

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Despite the considerable development of the calculus in the 18th century and the early rise of foundational debates over the status of the infinitely small, the history of the calculus in Prague begins only in 1765 when Stepling's *Calculus differentialis* appeared. The first systematic textbook on the subject draws in a way from Euler's *Institutiones* but, at the same time, comes up as an original foundational attempt to explain the nature of the infinitely small in an arithmetical way. We shall devote the first part of the talk to the peculiarities (and failures) of Stepling's strategy as compared with the approaches of Euler, d'Alembert and others. While the concern of Stepling's work was logical in nature, the purpose of the other textbook we shall treat, Vydra's *Elementa calculi differentialis* (1783), was clearly limited to teaching: even though it was in fact a very simplified version of Stepling's *Calculus*. However, a major difference remains. Vydra, Stepling's disciple and successor, makes use of geometrical diagrams to illustrate Stepling's techniques deliberately freed of all geometrical reasoning. In the second part of the talk we will offer an analysis of the rather surprising teaching practice. In the end, we give some concluding remarks on the relations between foundational and educational issues about the calculus in 18th century Prague.

Contribution ID: 433
Wendlingen: a Bohemian scientist in the Eighteenth Century Spanish Court

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In the mid-eighteenth century, the Spanish Bourbon Monarchy wanted to link science with the task of renovation of the institutions based on the well-being and the progress of the country. The still powerful

Society of Jesus was one of the sectors at the service of the Crown in the process of "modernization" where science and technology were identified with material progress of the society. Around 1750 the Society of Jesus sent Johannes Wendlingen (1715-1790), who was a Jesuit mathematician and teacher in Prague, to the Imperial College in Madrid. Wendlingen became professor of mathematics in this college, a Cosmographer of the Indies and tutor of the princes. He was charged by the Spanish Crown to establish an astronomical observatory in the Imperial College that would have connections with the network of Europeans observatories.
The aim of our paper is, on the one hand, to show Wendlingen as an active agent of applying mathematics to the technological development of the country, that is, as a technician supporting economic and military interests of the Spanish Crown. On the other hand, we want to emphasize Wendlingen's role as the one in charge of writing a complete course on mathematics, as a textbook for teaching in the Imperial College. The part of this treatise that is dedicated to differential calculus deserves special attention since it shows us Wendlingen as one of the introducers of infinitesimal analysis in Spain, a very scarcely known field at that time in this country.

Session V Cold War

Contribution ID: 1024

Shaping Cold War science: The case of Herbert Simon and Hao Wang

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From 1947 to 1991, the United States of America (USA) and the Soviet Union were in conflict. Science was important during this period because it helped to shape the discourse that human decision making could be emulated for avoiding conflict. In this context, the political scientist Herbert Simon and the physicist Allen Newell developed the first artificial intelligence (AI) program known as "The Logic Theorist". This computer program could simulate capacity of humans for solving problems of logic. The Logic Theorist could solve thirty eight out of fifty-two problems of the book Principia Mathematica written by Bertrand Russell and Alfred Whitehead. The philosopher Hao Wang disagreed with Simon and Newell's work, showing that his computer program could solve most of the problems of the Principia. Even though Wang's program was better, it was not taken seriously. This situation could have happened because Wang came from China, and during that time the USA-China relations were very tense. Moreover, there was an association of early AI with the development of Cold War rationality. This paper aims to show the importance of connecting local and global history for understanding how scientific production was shaped during the Cold War.

Contribution ID: 884

One shall not kill the science. Kazimierz Petrusewicz and the attempts at the stalinist transformation of the Polish academic field

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The empirical core of my paper will be a closer look at one biographical trajectory: that of the Polish biologist and political activist Kazimierz Petrusewicz (1906–1982). In the 1930s, in parallel to a promising

scientific career, he belonged to the leaders of the Union of the Academic Left 'Front' in Vilnius – one of the most intriguing phenomenon within the Polish communist movement, struggling to overcome its isolation amongst the intelligentsia milieus. In the years 1949–1952 Petrusewicz was, in turn, a head of the Department of Science and Higher Education of the Central Committee of the Polish United Workers' Party, at the same time carrying on his scholarly work as a professor and one of the chief propagators of Lysenko's concepts. His experiences will provide me with a starting point for a broader reflection on the relationship between Polish political and scientific fields in the first post-war decade. Did actors such as Petrusewicz situate themselves at their intersection, integrating them, or rather serve as an example of intrusion from one to another? What were their key cultural and political capitals? To what extent were the attempts at the Stalinist transformation of Polish science rooted in the inter-war communist habitus, both in the context of consistency as well as contradictions and tensions?

Session VI (Part 1/3) - Academies, Societies, Laboratories and other Institutions

Contribution ID: 1208

Cooperative empires: Scientific societies in Vienna, imperial agents, and the "Orient" (1870–1914)

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In the second half of the nineteenth century, scientific societies were one of the most influential modes of scholarly organization. Bringing together professionals, practitioners, and sponsors, these associations saw themselves primarily as communication hubs providing favorable framework conditions for cooperative endeavors. In the Habsburg Monarchy, they became powerful private-public interfaces that carried out political tasks while also serving as organizations of civil society building. Supported by the imperial administration, members such as scholars, politicians, officials, military officers, teachers, and business owners volunteered for large-scale cooperative projects, built up enormous collections and undertook expeditions. This is especially true for the scientific research on the Balkans and Asia Minor, a patchwork of diverse geographies labelled under the stereotypical term "Orient" and commonly regarded as the monarchy's "natural" research domain.
Based on archive research, this paper examines the social interactivity, hierarchies and various scales of actors within two selected associations, the "*Oriental Committee of the Imperial-Royal Geographical Society*" (1869-78) and the "*Natural Scientific Oriental Society*" (1895-1938). Associations are a novel lens on both macro- and micro-historical processes of knowledge production and dissemination, as well as an apt point of departure for research into scholarly cooperation and boundary-work within and between institutions. Particular attention will be paid to (1) the growing demarcation processes between professionals, practitioners, and sponsors, and their influence on the associations' orientation and scientific practices and (2) the role of these associations before the rise of universities and the founding of highly specialized extramural scientific agencies.

Contribution ID: 1098

Cooperation between Russia "Giants" and "Dwarfs" Scientific Centers in the Formation of a New Scientific and Educational Landscape in the First Years of Soviet Power

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Solving the pressing problems of the development of enlightenment, education, and culture in Russia was an important component of the revolutionary transformations carried out by the Soviet government in the first years after the October Revolution. This position of the government received full support and understanding from the scientific intelligentsia of the scientific centers, which for decades sought to provide all possible assistance to their colleagues in the province.
The aim of this paper is to discuss certain forms and methods of the relationship between scientific centers and the intelligentsia in the periphery and its historical experience. The study is based on a variety of sources, primarily archival materials from the St. Petersburg Branch of the Archive of the Russian Academy of Sciences, and periodicals of provincial universities created in the early years of Soviet power.
In many respects, as a result of cooperation between central and provincial scientific centers, a new culture infrastructure, new educational and scientific institutions and public organizations were created. Scientific centers were sending a bunch of scientific and popular-science publications to province institutions during the first postrevolutionary years. In the provincial cities work was carried out to save the monuments of history and culture, the acquisition of museum and archival funds as the basis for future research. This work was conducted by metropolitan scientists and specialists who lived and worked in those years on the periphery, and their provincial colleagues. For the first time, significant areas of the country were subjected to a systematic comprehensive study. In fact, in the first years of Soviet power, the complex process of changes in the scientific and educational landscape in Russia was quite successful.
The reported study was funded by RFBR, project number 20-011-00204.

Contribution ID: 1186

To establish the Japanese society for history of science; two phases and historical backgrounds.

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To establish the Japanese society for history of science; two phases and ideological backgrounds.

To make history of science into a discipline in particular Country, it is necessary to establish academic society. Some historians had told that there was a movement to establish the Japanese society in 1930s Kyoto. Though this society, Nihon-Rigakusi-Kai(日本理学史会), was not realized, the Japan Society for History of Science, Nihon-Kagakusi-Gakkai (日本科学史学会) started in 1941 Tokyo. With some articles of Kyoto society, we found recently, this paper shows the target group of the academics and the difference between those of Tokyo society.

As Japanese Physicist Ayao Kuwaki(桑木彧雄 1878-1975) introduced George Sarton in Japanese magazine *Warera(我等)* in1920, Japanese intellects of the age started to study history of science. Some historians of science translated *The Outline of History by H. G. Wells* (1919-1920) into Japanese, *Sekaibunkasi-taikei (世界文化史大系, 1927-1928)*.
In 1931, Japanese astronomer Kazukiyo Yamamoto(山本一清 1889-1959), who was also professor of the Kyoto Imperial University, started to establish the society for history of science and named Nihon-Rigakusi-Kai(日本理学史会) but it was not realized. Yamamoto left a list of scientists to call as a member for the society, but the list had been analyzed yet. The list shows the target of the member, mainly established Professors and elder Scientists around Kyoto.
In 1941, Scientists and Younger Philosophers established the Japan Society for History of Science (日本科学史学会) and made an office at Tokyo. The Society made 80 years history.
Between two phases, the "External Approach" introduced by Boris Hessen and Japanese study group started Social approach for the history of technology. Tokyo Society included new approach which Kyoto group dismissed and focused on pure sciences on the other hand.

Symposium Gas and electricity as an element of technological development in Latin Europe: technicians, processes, gas works, and networks (ICOHTEC) - ID 1314

Contribution ID: 1315
ENGINEERS AND TECHNICIANS IN LATIN EUROPEAN GAS INDUSTRY (1914-1945)

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In 1874 the *Société Technique d'Industrie du Gaz en France* was born, and it became one of the main associations in the World and European gas sector. In 1877 its members founded the *Journal des usines à gaz* (1877-1958), which turned into a reference journal for entrepreneurs and technicians in the gas industry. For this reason, we have decided to use that source and recover back the memory of the engineers and technicians that participated in Latin European gas industry, in the years between 1914 and 1945. Focusing on Spain, France, Italy, and Portugal, we will also use scientific literature about those engineers and technicians. The year 1914 was a turning point, since the start of the First World War meant a crisis in the gas sector, due to the difficulty to get the coal needed. The same problem happened in the Second World War. In contrast to both crises, the 1920s saw the growth of the sector because of new uses of gas, especially at the people's homes. Consequently, in the Inter-War Years distribution networks and gas transportation were enlarged, and factories were modernised.

Contribution ID: 1316
Gasworks in spain, the knowledge based in the technological diffusion

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The coal gas technology, although had no spectacular changes over the years, have had a series of technical improvements. In Catalonia the gas industry started mainly by the participation of foreign technicians, but the Spanish technicians improve to know the technology and technique of gas for streetlights
This paper intends to study some technical improvements that took place in Spanish gas works, and we will focus on different projects of gas works, some of which were fully developed and others remained only like a project.

Contribution ID: 1317

The adoption of the electricity in Barcelona at the nineteen century and the actuation of the gasworks

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Until the Barcelona society perceived the importance of the electricity, its introduction was modulated by the presence of the implanted gas for 40 years ago. With the creation of the first utility in the city to exploit the power electrical industry, the gas industry reacts and defends its position and customers from the technological point of view. During the last years of the nineteen-century gas and electricity compete and develop initiatives
The aim of this paper is to analyse the importance of the introduction of the electricity in the main industrial city in Spain, Barcelona, and the technology adopted by the utilities that were created, with the intervention of the European technology, and emphasize how the gas industry improved at this time.

Session VII (Part 1/2) - Biographies

Contribution ID: 1116

"Narro, ergo sum" – Comparing autobiographical narratives in the history of Austrian science

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When a member of the scientific community was honored by being elected into the prestigious Academy of Sciences in Vienna, a high status amongst contemporaries can safely be assumed. But how did a newly elected member perceive their own status amongst their peers? Autobiographical narratives provide a unique opportunity to examine self-perceptions, growth factors and reward systems in a given scientific community.
To better understand and describe value systems in science, I have accumulated more than 180 CVs in total from the late 19th century to the early 20th century of members of the Academy of Sciences in Vienna. I use the institutional framework of the academy as a limiting factor, yet, within the sample there are scientific figures of different degrees of familiarity as well as various social and disciplinary backgrounds.

I argue that the way fame and recognition is conferred to an individual by the community at large, is not only contingent on their scientific achievements or cognitive abilities but also to a degree on their ability to present themselves in their respective social and political environments. When speaking about themselves, they employ strategic maneuvers to impress, justify or inscribe oneself into the history of science as being important and memorable. How do they praise themselves while remaining modest? How do they position themselves in relation to peers? Equally important as "giants" will be lesser-known figures and factors that might have inhibited a "dwarf's" higher profile.

Contribution ID: 1249

Von Mises, Reichenbach, and Popper on the law of large numbers

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At first glance, the weak law of large numbers (WLLN) seems to be an almost trivial statement in the frequentist interpretation of probability, i.e., if a probability p is perceived as a relative frequency h(n) in the long run. Yet, the statement that for Bernoulli trials P(|h(n) – p| > a) tends to zero, contains two probabilities p and P, and its analysis in frequentist terms is far from being trivial. In my talk I will discuss the basic ideas which von Mises, Reichenbach, and Popper employed in connection with the WLLN. Whereas von Mises (1919) stressed the analytic properties of distribution functions and only later tried to give an explanation in the direct context of his „Kollektivs", Reichenbach (1932/35) aimed at a discussion of the differences between the „formal" and the frequentistic approach. For Popper (1934/35) the WLLN was a motivation for weakening the assumption of hypothetic limits of relative frequencies which was the usual basis of frequentist theories.

Contribution ID: 1252

Boscovich and Leibniz. A reappraisal

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Ruggiero Boscovich's conception, as exposed in his *Theoria philosophiae naturalis* (1758/1763), has frequently been viewed as an attempt to connect Newton's and Leibniz's natural philosophies into a unified framework. There is virtually no scholar dealing with Boscovich's physics who does not quote the famous passage from the *Theoria* posing it as a "midway between the system of Leibniz and that of Newton." Influential examples include Ernst Cassirer (*The Problem of Knowledge*), who took Boscovich's theory as part of the eighteenth century effort to reconcile "the opposite philosophies" of Newton and Leibniz; Mary Hesse (*Forces and Fields*), who emphasized the role of monadology in Boscovich's conception and viewed it as integrated with Newtonian physics; Max Jammer (*Concepts of force*), who considered Boscovich as a crucial representative of dynamism, this being a mix of Newtonian elements and Leibnizian ideas and culminating in the notion of force as "the ultimate element of reality".
Notwithstanding these assertions, research so far has only succeeded in giving fine-grained reconstructions of Boscovich's sources within the Newtonian tradition, whereas extant studies on Leibniz's Boscovichean legacy have mostly been limited to the analysis of conceptual convergences. By contrast, the present paper puts in the foreground the "Leibniz of Boscovich". It aims to: 1) identify

Leibnizian themes and sources in Boscovich's works; 2) reconstruct how he became acquainted with them; 3) illustrate if and how those themes were adapted to, and/or entered in tension with, characterizing tenets from his Jesuit background.

Contribution ID: 1330

Some Research Directions Represented by N.D.Moiseev in his Monograph Essays on the Development of Stability Theory

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This presentation considers the book by Professor N.D.Moiseev (1902-1955), a distinguished Soviet scientist and a specialist on celestial mechanics and motion stability theory. This monograph provides an informative and detailed analysis of problems of the equilibrium stability and the motion; along with that, it is also a true encyclopedic guide in the field.
The writing by Moiseev establishes historical and conceptual meaning of different theories. The research covers the time interval from Aristotle through Lyapunov. In his work, Moiseev focuses on the development of the main version of the theory of infinitesimal stability, which was successfully evolved into the brilliant stability theory in the sense of Lyapunov. Moiseev tries to highlight all the essential special features of this theory.
The book contains the review and analysis of basic stages in the development of stability theory in the field of exact natural science and engineering. It consists of several essays corresponding to Moiseev's periodization.
Essay 1 titled The Development of Stability Theory in Pre-Analytical Period covers some dozens of authentic tractates of antique and mediaeval scientists, inclusive the epoch of the great 17th century. The author examines a concept of static-frictional stability introduced by ancient mathematicians. In addition to the kinematic variant of statics of «simple machines», the stability theory of geometrical statics is analyzed. Further, stability theories in the physical statics are presented, beginning with teachings of antique philosophers concerning the stability of floating bodies in the sense of Stevin and the Torricelli's equilibrium stability criterion.
Essay 2 titled The Development of the Infinitesimal Theory of Stability includes six extensive chapters, which examine the theory of small oscillations of a conservative system and the theories of secular perturbations of planets, as well as the analysis of some technical problems.
The vast Essay 3 is titled Lyapunov's Writings on the Stability Theory where the rich Lyapunov's scientific heritage is thoroughly considered over a length of five chapters, beginning with his early works (1884) through his latest contributions to this field.
Conclusion highlights an importance of Lyapunov's theory in the historical perspective.

Symposium (Part 1/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 204

Contribution ID: 293

Transformations: Turning research experiments into teaching demonstrations

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A few experiments from the history of physics did not just make it into the modern textbooks but also onto the demonstration table in the lecture hall. However, taking a closer look at the instruments used in the initial experiments and those representing them in the teaching demonstration reveals some substantial differences. Even though there are visual resemblances, the operation and the function of the teaching devices may differ substantially from the initial instruments. In comparing the devices, one may identify two major groups of objects that were produced for teaching (and are still found in history of science museums):
(1) Some instruments are able to produce the *phenomena* or *data* related to the historical experiment, yet in a manner that does not require much competence by the demonstrator. Thus, even though they are functional in the sense that they can produce the desired scientific "outcome" – the product of the historical experiment – their performance can hardly be taken as experimental, as there is little or no genuine interaction by which the experimenter can carry out an analysis. Such devices act rather like automata – they produce the accepted data, but can hardly do anything else.
(2) Other instruments better address the *operation* and *manipulation* of the historical apparatus – the *process* of the experiment. However, these apparatuses cannot produce valid data. Instead, they demonstrate the performance in the experiment and enable the lecturer to address various aspects.
In my presentation, I will discuss these two types and illustrate them with practical examples.

Contribution ID: 463

Tracing the life of 19th century laboratories in Greek educational institutions through historical textbooks and archival documents

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The purpose of this paper is to trace the life of 19th century laboratories in Greek educational institutions, whose equipment has either been destroyed or not restored yet. We will discern two different periods, the first before and the second after the Greek Revolution of 1821.
The pre-revolutionary period is characterized by the Greek Enlightenment cultural movement. Within its framework the teaching of science was introduced, for the first time, in innovative schools, which constituted the highest level of Greek educational institutions. In his popular '*Science Textbook for the Beginners of the Philological School of Smyrna*' written in 1812, a prominent scholar of that period, Konstantinos Koumas, included illustrations of the scientific equipment of his school and proposed to utilize them as a guide to organizing new science laboratories. Using the above historical information, we are going to reconstruct an image of science teaching in the pre-revolutionary Smyrna, when children and adults frequented the Philological School to attend the science lectures.
During the post-revolutionary period *Athens University* was established, and its laboratories began to be professionalized. Through archival documents we trace the teaching of science from the 1840s to 1890s. New instruments bought indicate the new chapters of physics introduced, while the professors' correspondence about the repair and improvement of the experimental setups are valuable sources for

laboratory life. All this information plays the role of a time-machine allowing us to imagine series of experiments performed and lecture demonstrations presented on the characteristic 19th century amphitheater bench.

Contribution ID: 394

The impact of salih zeki's optical works on physics education in 20th-century ottoman turkey

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From the beginning of the 18th century, Ottoman rulers accepted that they had fallen behind in military technologies and initiated an extensive reform movement in technical training. During this period the engineering schools and the very first modern university in Ottoman Turkey were established. This endeavour was enriched by an extensive movement of translations from the Western sources. Salih Zeki (d. 1921) constitutes an important figure in this reform movement, as his treatises on physics and mathematics allowed advanced physics to gain importance in Ottoman Turkey. His treatise *Ḥikmat-i Tabīʿiyya* is a work explaining terminology in general and experimental physics in detail. It therefore became a source book in physics education in Turkey until the fall of Ottoman rule. His *Mabḥath-i ḍiyāʾ*, however, is particularly important for instrumentation. The use of microscopes and telescopes are explained in the section titled "Instruments of Light" (Ālāt-i Ḍiyāʾiyya) with a special attention to the telescopes invented and used by Galileo, Newton, and Herschel. By examining the works of Salih Zeki our aim is to measure the amount of information on optical instruments a university student in Ottoman Turkey could acquire. Our study aims to discuss the availability of the experimental practices of optics based on Salih Zeki's treatises. We also examine the accessibility of then-university students to the optical instruments as well as what type obstacles were there to be dealt with for observations and experimentations using microscopes and telescopes in Ottoman Turkey.

Contribution ID: 263

Robert Pohl in Madras: German teaching instruments and practices in India

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In the 1920s and 30s, Göttingen physicist Robert Pohl developed a system of lecture demonstrations that modernized physics teaching and dominated experimental physics lectures in Germany up to the 1970s. For all I know, Pohl never went to Madras. His lecture demonstrations, however, travelled all over the world through his textbooks, his students, his instruments, and through the global networks of the instrument company Spindler & Hoyer that marketed Pohl's instruments.
What happened to these lecture demonstrations when they travelled and crossed climatic, political, social and cultural boundaries? In my presentation I will follow Pohl's lecture demonstrations to the Indian Institute of Technology (IIT) Madras, together with Werner Koch, who had been Pohl's student in the 1920s. Koch was appointed Professor of Physics at IIT Madras, which was set up with West German assistance between 1959 and 1974. I will discuss the problems that Koch encountered in the transfer of

teaching instruments and practices from Germany to India. Koch's plans to replicate Pohl's lecture demonstrations at IIT Madras had to face a number of obstacles including climatic conditions and lack of infrastructure but also different ideas and practices among Indian and German actors how IIT engineers should be trained. Koch and other German professors wanted teaching for engineers largely practice oriented. Their call for "re-educating" Indians, I argue, ignored social differences and hierarchies on both sides.

Session III (Part 2/3) - Geography

Contribution ID: 1068

History of drought in Brazil: notes about the co-production of infrastructures, national policies and local realities

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In this paper, we explore the co-production processes of drought infrastructures, national policies, and local realities in Brazil. Our focus will be on the activities of the Department of Infrastructure Against Drought (DNOCS), created in the 19th century. Based on the data collected in the DNOCS archives, this paper discusses how the concept of drought and the policy against drought arises together with the construction of infrastructure. Our theoretical bases are the Science and Technology Studies (STS), mainly, the Infrastructures Studies that recognize that infrastructures are constituted by heterogeneous networks of actors and co-emerge with the political and social structures of their time (EDWARDS, 2010; STAR, 2010; BOWKER, 1995). Brazil has a long history related to drought. Since the imperial era, successive governments have discussed actions to improve de resilience of the people of the dry regions in Brazil. Large public funds were expended to made dry regions habitable and susceptible to the economic and social development initiatives. Despite these expenditures, infrastructures and policies have not resulted in a development model expected but have created local political realities that have established forms of government based on these infrastructures. This work addresses how these local realities have changed, historically, with the construction of infrastructures.

Contribution ID: 1086

Beyond Scientific Ingenuity: The discovery of the "Dansgaard-Oeschger Events" and its socio-political context

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Half a century ago, two physicists from small European ountries revolutionised a minor research field and transformed it into one of the most powerful disciplines within climate science. With their work on ice cores, Hans Oeschger (1927-1998) in Switzerland and Willi Dansgaard (1922-2011) in Denmark set the basis for a new scientific field that would fundamentally change our understanding of climate and climate change. It also enabled Switzerland and Denmark, despite their small sizes, to become big players in paleoclimate research. Eventually, the "Dansgaard-Oeschger events" (abrupt climatic changes in the past) have been named after the two physicists, acknowledging their key roles in the discovery. However, the success of these two scientists did not just root in their scientific ingenuity alone. It also

required good timing, engagement in interdisciplinary collaboration and scientific competition, and the skills to build an international network. What were the specific political, cultural and scientific settings in Switzerland and Denmark respectively that allowed these physicists to thrive and successfully compete with scientific superpowers like the USA or France? Who were the "dwarfs" that enabled such a discovery like the Dansgaard-Oeschger events, and what was the role of team spirit and networks in general? Drawing on archival sources from both countries, this presentation will investigate such questions, analyse how and why these two scientists became "giants" in climate science, and reflect on the role of the archives in how this story has been and can be told.

Contribution ID: 1145

Development of geomorphology in the USSR at the initial stage: scientific contribution of Innokentiy P. Gerasimov and Konstantin K. Markov

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In 1918 Educational Geographical Institute (future geographical faculty at Leningrad University) and the Department of Industrial and Geographical Study of Russia (future Institute of Geography) at the Academy of Sciences were created in Petrograd. This contributed to the development of a number of areas of geographical science, in particular, geomorphology. Educational Geographical Institute has trained many geographers; among them were such outstanding geographers as Innokentiy P. Gerasimov (1905-1985) and Konstantin K. Markov (1905-1980). In the 1920-50th their scientific activities contributed to the development of geomorphology, a scientific discipline about the study of the Earth's relief.
In 1937 I. Gerasimov published the book "The main features of the development of the modern surface of Turan. The experience of a geomorphological monograph", which had a significant contribution to geomorphology. In the 1950th I. Gerasimov made a great impact on structural geomorphology, when created the theory of morphostructures and morphosculptures.
K. Markov contributed the paleogeographic direction in geomorphology when in 1935 he published the monograph "Development of the relief of the northwestern part of the Leningrad region". In 1939 I. Gerasimov and K. Markov published joint monographs "Ice Age on the Territory of the USSR" and "Quaternary Geology: Paleogeography of the Quaternary Period". Ideas of those scientists laid the historical direction in geomorphology and the comparative-geographical approach to the study of relief.
The research was carried out with the support of the Russian Science Foundation according to scientific project № 20-78-10095 «Soviet science as an industry: personnel, infrastructure, organizational and management practices (1920-1970s).

Contribution ID: 1129

GIS-Mapping and Building Territorial Planning In Colombia

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This article seeks to do an explanatory description of the development of geographical information systems (GIS) and related mapping technologies applied for territorial planning in Colombia. It focuses on how they are intertwined by notions of normative approaches of technology use and ontological states about territorial realities. Since the 1990s, Colombian government and local agencies have given special attention on GIS mapping and its qualitative data to build a robust knowledge framework about its geography, key sectors, and themes, such as transportation, natural resources management, population, and services. Today, there are few questions about its overwhelming presence in national and local decision-making, posing problematic concerns about how the State is building a type of GIS territorial governance.
The article stands from historical GIS (Gregory & Ell, 2007; Knowles, 2008) and critical geography (von Lunen & Travis, 2013), in order to describe the development of GIS application on natural resources and conflict management, both themes that have a central agenda in the last two decades. By doing so, it explores the idea of how the government builds visualizations of reality and related types of governance upon GIS technologies and narratives (DeBats & Gregory, 2011).

Symposium (Part 2/3) The Greek and medieval Ptolemy (CHAMA) - ID 92

Contribution ID: 113
Tracing Arabic translations of the Almagest in al-Farghani's Elements of Astronomy

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According to historical evidence, we know of at least four Arabic translations of Ptolemy's *Almagest* in the course of the ninth century, of which only two have survived. The remarkable investment of Arab scholars in improving translated versions speaks of a continuous attempt to establish a well-received knowledge of astronomy through a dependable translation. The fact that the same concepts attributed to Ptolemy were exposed to different linguistic formulations, implies a high concern for the readability and approachability of the text. Through this variety of mediations, the need for a standard language that could be comprehended and written upon was soon recognized as an essential prerequisite for the development of the astral sciences. In parallel to the direct knowledge of the *Almagest* circulating through translations, Muslim astronomers began commenting and discussing Ptolemaic theories in separate compilations. I will follow the line of linguistic development through the case of al-Farghānī's *Elements of Astronomy*, written in the first half of the ninth century. Written as a paraphrase on Ptolemaic astronomy, this book stands as a well-preserved text coming from a generation between the two surviving translations of the *Almagest* (the versions of al-Ḥajjāj and that of Isḥāq b. Ḥunayn revised by Thābit), which makes it a good witness in observing the thread of assimilation of Ptolemy's terminology. By tracking examples of al-Farghānī's terminology in the Arabic translations of the *Almagest*, we will see how a technical language of astronomy was shaped through the interactions of multiple actors in the ninth century.

Contribution ID: 342

An Almost Forgotten Contribution to the Tetrabiblos

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This talk looks back at the beginnings of the history of the Arabic Tetrabiblos in 9th-century Baghdad and reconstructs, based on manuscript notes, Thābit ibn Qurra's (d. 901) comments on the text. The study of the early transmission of the treatise has been plagued by a severe lack of data. According to the current state of research, the Tetrabiblos was first translated by ʿUmar ibn al-Farrukhān al-Ṭabarī (d. 815). Another version probably based on a lost translation by Ibrāhīm ibn al-Ṣalt goes back to Ḥunayn ibn Isḥāq (d. 873). Individual manuscripts of this version contain quotes attributed to Thābit ibn Qurra, mostly in the form of annotations, in the margins of all four books. Some of the scribes even mention Thābit, contrary to popular opinion, as a revisor of Ḥunayn's version of the Tetrabiblos. Historical biographical sources such as Ibn al-Nadīm, on the other hand, do not mention any corrections by Thābit but acknowledge his glosses to the first book. Other sources, like Ibn Abī Uṣaybiʿa, mention a complete, but apparently lost commentary (Kitāb fī tafsīr al-arbaʿa) by Thābit. Thābit's remarks are not transmitted in any derivative works: neither al-Battānī's nor ʿAlī ibn Riḍwān's renowned commentary includes references to Thābit. A close examination of the extant Arabic manuscripts of the Tetrabiblos with focus on marginal notes will give a better understanding of Thābit ibn Qurra's contribution. This examination seeks to reconstruct parts of the lost text, to understand its purpose and to illuminate the circumstances of its fading prominence.

Contribution ID: 112

(Dis)continuity of Ptolemaic planetary distances and sizes in Arabic astronomy

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Ptolemy's scheme for finding planetary distances and sizes, discussed in his *Almagest* and *Planetary Hypotheses*, passed down to Muslim scholars as early as the ninth century through the Arabic translations of these works. Ptolemy took advantage of four sets of factors for measuring the size of the cosmos: 1. natural philosophical doctrines, 2. astronomical models for the planetary motions, 3. a certain number of observational data, and 4. computational methods. Although the outline of Ptolemy's scheme remained unchanged throughout the Middle Ages, Arab astronomers were reluctant to accept its details. Hence most Arab astronomers sought to rectify his program, inter alia, by the juxtaposition of his convictions and recalculation of his steps. They achieved results incompatible with Ptolemy which can be amply seen in the Arabic sources. These discrepancies largely emanate from changes in the four sets of factors entering into the process of calculation.
In this presentation, I intend to categorize the reasons and the ways Arab astronomers deviate from Ptolemy by exploring the outline of schemes developed by from the ninth to the fifteenth centuries. The change in the order of the planets suggested by al-ʿUrḍī and presupposed by al-Shīrāzī will be briefly discussed. Finally, al-Kāshī's refutation of al-ʿUrḍī's perspective in *Sullam al-samāʾ* will come to my focus.

Contribution ID: 174

A philological chimera: Pseudo-Ptolemy's Book of the Fruit and its transmission

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Until relatively recent times, Ptolemy was considered a giant not only on the authority of his Almagest and Tetrabiblos, but also on that of the Book of the Fruit falsely ascribed to him. Some forty translations and commentaries dealing with its astrological, philosophical and medical aspects make clear that this short work is far from being a derivative pastiche. The multilingual corpus survives in several hundred manuscripts spanning over one millennium and seems to ultimately irradiate from the Arabic version of the base-text. This version, however, is only rarely attested in manuscripts prior to 1700. Therefore, in order to properly study the origin and diffusion of the Book of the Fruit, one has to reconstruct an earlier stage of the text by carefully integrating into a stemma the translations and commentaries representing its indirect transmission. It will be shown that the best way to cope with the conspicuous amount of relevant witnesses is to combine traditional philology with computerised stemmatology.

Symposium (Part 2/7) 16th Annual Symposium of the Social History of Military Technology (ICOHTEC) - ID 125

Contribution ID: 212

The trace italienne, a military innovation with dramatic consequences on the besieged. The siege warfare during the Italian Wars (1494-1559)

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This paper aims to demonstrate that the development of the *trace italienne* during the Italian Wars (1494-1559) had dramatic effects on the besieged. The bastion fort (best renown as *trace italienne*) was a low and deep fortification that could be considered as the turning point for the Renaissance European art of war: it made fortresses impregnable by assaults. As a result, besiegers adopted strategies to cut off forts' supply lines, waiting until defenders were short of food, and forced them to surrender. During the Italian Wars, there were several remarkable sieges during which inhabitants suffered for hunger and diseases (Pavia, Naples, and Siena). The sixteenth-century sieges were dramatic for defenders: not only they needed protection from enemies, but they also faced diseases and hunger. Before the capitulation, the besieged could have spent several months in tragedy. Several inhabitants died for diseases and starvation; then, when provisions were short, defenders expelled the so-called *bocche disutili* (the "useless mouths"), that died in the no man's land, rejected by besiegers and besieged. Extending the defensive capabilities of a fortress, the besieged needed more provisions to resist. For this reason, at the same time, the *trace italienne* prolonged the inhabitants' pain and their risk of dying. The paper explores, from a bottom-up perspective, the impact of the *trance italienne* on inhabitants' life during a siege analyzing some remarkable case studies such as Siena (1554-55) to show that the defensive capabilities of a city became in direct proportion to inhabitants' pains.

Contribution ID: 438
Italian imitations of French ordnance: an artillery revolution, or a logistical problem?

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After the infamous invasion of the Neapolitan Kingdom, in 1495, Italian princes were utterly astonished by the effectiveness of the French cannons, described by contemporary chroniclers as "rather diabolical than human instruments" because of their mobility and destructive power. Corroborated by the opinion of several major condottieri, this initial impression contributed to the swift assimilation of the foreign artillery: already in 1496, "French-style" guns were manufactured in Florence and in Ferrara, in Naples and in Rome, in Milan and in Siena. Within 1499, the extraordinary diffusion of the new firearms, along with the introduction of original siege tactics, urged the production of powder, carriages, and shot, contextually increasing the demand for copper, wood, and saltpeter: it was the beginning of a lasting "revolutionary challenge" to military logistics.
Through contemporary sources, the paper aims to reconstruct various aspects of the munitions supply during the late fifteenth and the early sixteenth century. Highlighting the political response to the growth of military market and stressing the economic impact of the development of siege ordnance, the analysis concerns the difficulties of arms procurement and the productivity of public factories, as well as the mobility of skilled labor and the experimentation on technological hybrids. Finally, the research hints at the establishment of one of the first state monopolies, that is, the early modern artillery industry.

Symposium Socialist Hydro-Expertise in Cold War Ghana: Cold War Technopolitics Beyond the Giants? (ICOHTEC) - ID 552

Contribution ID: 913
Export of Czechoslovak Hydro-expertise in the Cold War Era

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Bulk of literature problematizing global knowledge and technology transfers in the Cold War period tends to overlook Eastern European socialist countries. This contribution aims at filling the gap by focusing on the export of hydro-expertise from socialist Czechoslovakia. Building upon strong domestic tradition of hydraulic engineering (Polytechnic Institute in Prague was established in 1803) and availability of soviet expertise (soviet advisors, literature, but also study stays for Czechoslovak experts in the USSR), Czech water experts acquired leading position in the field within the socialist bloc (outside of USSR). During the 1950s, they participated in development of water management sector and dam building in Bulgaria, Romania and Poland, and in late 1950s also in China. After 1958 (at the same time as in the USSR), Czechoslovak authorities attenuate national hydropower programme. Simultaneously, however, they launched programmes of foreign aid framed as scientific-technical cooperation with third world countries, which offered Czech experts a perfect opportunity to practice and further develop their expertise. By late 1960s, Czechoslovakia started to export water relate expertise also under the rubric of

UN activities (UNDEP), and COMECON. Over the 1970s and 1980s, Czechoslovak water experts were active in various countries (Ghana, Iran, Laos, Vietnam).

Contribution ID: 637

Long Shadow of Colonialism. Path Dependence and Hydropower Projects in Ghana

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In the abundance of energy resources there have been significant issues of policy gaps and electricity supply crisis. In Ghana, a "Hydro- Dam Scheme" was first initiated in the Colonial regime (1920-1956) to develop Ghana's river resources in order to enhance reliable power supply to Aluminium industries through the construction of dams.
When Kwame Nkrumah became the first Prime Minister and later the President Ghana between 1952 and 1966, he dreamed to transform Ghana into a society shaped and driven by the power of science. At the heart of Nkrumah's plan was the utilization of Ghana's abundant hydropower resources that would provide huge quantities of cheap electricity, based on which Ghana would establish a modern, industrialized economy just within a generation time. Nkrumah's dream has never come true. Ghana derives energy from hydropower, oil, natural gas, solar, wind, however, hydropower forms only about forty-one percent of Ghana's renewable energy production.
This study focuses on colonial and post-colonial hydropower projects and especially the construction of the Akosombo dam. It contextualizes hydropower projects in Ghana as a large technological system, that has influenced energy policy in Ghana. This paper argues that modernisation of 20th century Ghana through hydro-electricity projects is paradoxical. Colonial hydro-power development was wrapped in the exploitation of natural resources and subjection of local population under the colonial regimes. In addition, post-colonial practices often follow path dependence, that is identified as one of the key reasons why Nkrumah dream of Ghana as hydropower superpower has never been realized.

Contribution ID: 666

Damming the Cold War – Czechoslovak technopolicy in Ghana

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At the beginning of sixties, just after Ghana gained its independence, the newly born state had to face many challenges; one of them was a weak economy. The first Ghanaian president, Dr. Kwame Nkrumah (1909-1972) started series of reforms. Economical development and Cold War politics were closely connected and river basins in states of "The Third World" often became places of their proliferation. Development of the country brought an opportunity for states of western but also eastern block to supply lacking technologies and experts in exchange for reaching some of their political goals. Exploiting of these opportunities - strategy of planning, using or providing technologies, in this case water technologies, to reach political goals is something what Christopher Sneddon or Gabrielle Hecht call "technopolicy".

Czechoslovakia as an eastern block state was quite active in application of hydraulic technopolicy. During the era of Cold War, Czechoslovakian water engineers from the state company called Hydroprojekt successfully worked for governments of Iraq, Yemen, China, Cambodia and many others. In 1961 a small group of Czechoslovakian experts was sent to Ghana. Their mission consisted of geological and hydrological survey; finding and marking of suitable places for future dams was also a part of it. Later, both governments also agreed that Czechoslovakian Hydroprojekt should prepare projects of Hemang and Tanoso hydro power plants.
This paper will focus on Czechoslovakian hydraulic technopolicy in Ghana, its goals and form and will prove, that technopolicy in a Cold War context was not just a domain of superpowers.

Contribution ID: 1089
Technocratic internationalism. GDR coal refinement and international cooperation during the early Cold War

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Coal refinement at first glance appears to be a field prone to autarky, even more so in early Cold War East Germany. The GDR was endowed in abundance with brown coal, but with almost no other natural resources. Moreover, it inherited the expertise and facilities for coal hydrogenation from the Nazis' autarky drive and war efforts. And indeed, the GDR brown coal conversion and refinement specialists worked on projects for substituting import fuels like oil and anthracite coal. However, the East German foreign trade bureaucracy also tried to export the seemingly autarky-prone technology to other countries, for instance, India and China. The East German coal experts were involved in international cooperation and technology transfers in- and outside the socialist world. Being part of an international epistemic community, they worked - already in the 1950s - in the UN Economic Commissions for Europe and the International Standardization Organization, whose main task was setting up infrastructures for international trade. Thus, I will argue that coal refinement policies in the GDR followed rather a technocratic developmental rationale than an autarkic one, while a tension between the specialists' professional ambitions and the foreign policy goals of the political bureaucracy (international recognition, competition with the West and gaining a stronger position inside the Eastern bloc) did persist. The presentation is based on archival material from the Bundesarchiv in Berlin (mostly the corresponding Industrial Ministries) and the experts' personal files in the University archive and library in Freiberg/Saxony.

Symposium (Part 1/3) CHCMS (History of Chemistry and Molecular Sciences) - ID 912

Contribution ID: 1298
Contributions of Central European chemists to the development of Brazilian chemistry in the 20th century

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The institutionalization of Chemistry in Brazil in the 20th century is related to the coming of Central European chemists, who immigrated to South America to escape of Nazi persecution in the 1930s and 1940s. Most of them were Jewish or had Jewish relatives and found in the immigration to Brazil a way to survive from the Nazi regime. Among these chemists, we found four relevant figures who contributed in the first Brazilian universities and institutions, the German chemists Heinrich Rheinboldt (1891-1955), Hans Zocher (1893-1969), the Austrian chemists Fritz Feigl (1891-1971) and Paul Kubelka (1900-1954). In this work we present trajectory of these refugee chemists in Brazil, focusing on their contributions to chemical research and training in Brazil and the obstacles they found in this new scientific environment. We also try to discuss the relations among Brazil, Germany and United States during Nazi regime and how the international politics among these three countries influenced in the coming of these chemists to Brazil.
Keywords: Brazilian chemistry, refugee chemists, international politics, scientific institutionalization.

Contribution ID: 1299

Restructuring for Profit and Progress: Organizational Change in Centre des Recherches d'Aubervilliers (1953-2020)

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Centre des Recherches d'Aubervilliers is a private research unit created in 1953 by the French company Pechiney. Throughout its history, the center belonged to chemical giants such as Pechiney-Saint-Gobain, Rhône-Progil, Rhône-Poulenc, and Rhodia. Today it makes part of Solvay. In spite of these frequent shifts in ownership, the center, a home to more than 500 employees, proved itself remarkably resilient to the corporate R&D influence. It kept its own character as well as a number of distinct research trajectories.
This does not mean that the center did not change. On the contrary, with a large degree of autonomy, it reshaped its own organizational structure following major trends in the chemical industry and adapting itself to the shifting corporate environment. Its directors had to address multiple challenges such as: 1) Along what lines should the laboratories be organized? Large disciplines or narrow specializations? 2) What should be the place of the market-logic in the center's R&D strategy? Should laboratories be accountable directly to business units or to the center's director? 3) Is chemical engineering a part of the center's "scientific function", of the "support function" or something else altogether? What about a shared physico-chemical analysis laboratory?
Overall, these considerations make us ponder on the notion of the research center itself and, to put in broadly, on the continuity of institutions through time. While solidly established in historical research, the paper's objective is to give insights on the impact of R&D organization for companies of tomorrow.

Contribution ID: 1300

'Nucleoproteins' 1959 Solvay Conference on Chemistry: a scientific network and (bio) chemistry state's case study in the late '50s

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Since its foundation in 1912, the Solvay Institute for Chemistry's Scientific Committee cared deeply about realizing Ernest Solvay's wish of a meeting dedicated to bio and organic chemistry. After several aborted attempts owing to a lack of this chemistry' "subdiscipline" 's representatives in the Scientific Committee during the 1920s, 1934 and 1953 Conferences were organized introducing two major advancements in bio and organic chemistry knowledge: the definition of macromolecule and DNA double helix. Based on these conferences 'success, the Scientific Committee decided to organize in 1959 another one dedicated to this field: 'the nucleoproteins'. However, times have changed. Since World War II, Solvay Conferences on Chemistry were no more unique representative of (bio) chemistry on international congress scene. Biochemistry emerged as a subdiscipline in the 1930s; it became self-reliant in the 1950s with dedicate gatherings focusing on this subdiscipline. With that in mind, we are wondering how the 1959 Solvay Conference on Chemistry is self-positioning in the international congress scene. On which scientific criteria has the Scientific Committee invited participants? What types of network turned out in this international conference's organization dealing with a subject at the forefront of biochemical research? Moreover, in 1958, Ilya Prigogine, a Solvay Institutes' major actor, took a strong position inside the institute leadership. This period marks the beginning of significant changes in the organization of Solvay Conferences on chemistry … and physics! Indeed, the administrative fusion of Solvay Institute of Chemistry and Physics in 1962 led to major changes in the scientific organization of Solvay Conferences. And it seems that move was reinforced with the critical review of 1959 Solvay Conferences on chemistry, an interesting case study since it depicts scientific network and (bio) chemistry state in the late '50s/beginning of the '60s.

Contribution ID: 1301

Local Tourism, Cultural Heritage and Chemical Sites in Japan's Chubu Region: The Role of Private Companies

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Japan's Chubu Region, with Nagoya as its central city, is the major industrial powerhouse of the country. As a result, there are a variety of industrial museums in the region, a majority of which have been founded and managed by long-standing prestigious companies like Toyota. The artefacts and sites they exhibit are usually characterized as "industrial heritage" or "cultural heritage," but some of them can be justifiably labelled as "chemical heritage" for its strong connection with the science. This presentation focuses on two examples of such "chemical heritage" and discusses how they have contributed to the branding and tourism of the cities in which they are located and of the companies that founded them: 1) The Chemical Lecture Theatre of the former Fourth Higher School (designated as "chemical heritage" in 2014 by the Chemical Society of Japan), housed in the open-air architectural museum, Museum Meijimura (est. 1965) in Inuyama City, Aichi Prefecture; and 2) The Naito Museum of Pharmaceutical Science and Industry (est. 1971) in Kakamigahara City, Gifu Prefecture, which houses world-class collections of books and artefacts pertaining to pharmaceutical science and industry as well as chemistry. The former was founded by the Nagoya Railroad Company (or *Meitetsu*) with its extensive railway network in the whole region, and the latter by Eisai, a major pharmaceutical firm of international standing. Their purposes of instituting museums and actual outcome of their involvement with

museums will be closely examined to illuminate how chemical heritage can be not only preserved but also meaningfully utilized.

Symposium Expanding the range of statistical mechanics: from Poincaré and von Zeipel to Smoluchowski and Fowler - ID 21

Contribution ID: 47

Stars as molecules: Poincaré and von Zeipel on globular clusters and the structure of the universe

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While the rise of statistical mechanics in the early 20th century is widely understood to be linked to its success in explaining laboratory phenomena like the photoelectric effect and Brownian motion, statistical mechanics also offered a means of understanding astronomical phenemena, such as globular clusters, and the structure of the Milky Way. In this talk, the contributions to the nascent field of statistical-mechanical approaches to stellar dynamics and cosmology by Henri Poincaré (1854-1912) and his student Hugo von Zeipel (1873-1959) are presented. Following William Thomson's calculation in 1901 of the dimensions of the universe based on stellar proper motion, and the publication of J. Willard Gibbs' *Elementary Principles in Statistical Mechanics* (1902), Poincaré realized the potential for extending Gibbs' approach beyond equilibrium systems, and exploiting it in stellar dynamics and cosmology. Von Zeipel heard Poincaré's lectures at the Sorbonne, and went on to realize the first statistical model of a globular cluster in 1907. Later work by Poincaré brought further extensions of statistical mechanics for understanding the stellar universe, laying the groundwork for twentieth-century theoretical astrophysics, and inspiring contributions from James Jeans, C.V.L. Charlier, A.S. Eddington, K. Schwarzschild, A. Einstein and others.

Contribution ID: 328

From Statistical Mechanics to Random Fluctuations: Marian Smoluchowski's Research Program, 1904-1917

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When statistical mechanics was enacted in the late nineteenth century, it appeared in the form of kinetic theory of matters that aimed to understand the thermodynamic properties of substances in terms of microscopic entities' collective behaviour. To the pioneers of this research field, the focus was finding the statistical averages of large-scale atomic or molecular systems and accordingly interpreting the macroscopic features of the systems under equilibrium. In this framework, the random variations of individual microscopic entities were often taken to be something "smoothed out" in the averaging process and thus did not exhibit interesting attributes. In the early twentieth century, however, statistical physicists began to pay close attention to a physical system's stochastic deviations from its

thermodynamic states, and explore in theoretical and experimental ways the characteristics of random fluctuations. In this paper, I examine the work of Marian Smoluchowski, a major contributor to this change of direction in statistical mechanics. Based at Lwow and Krakow in Austrian Poland before the collapse of the Habsburg Empire, Smoluchowski developed a career on the studies of random fluctuations. His topics included the variations of concentration in a solution, the mean free path of gaseous particles, the Brownian motion of suspended particles, and critical opalescence. He tackled these problems via Ludwig Boltzmann's mathematical and conceptual approach in statistical physics. In contrast to Boltzmann's preoccupation with why thermodynamics—especially its second law—works, Smoluchowski's focus was when and how thermodynamics stops working and we start to see the deviations from it.

Contribution ID: 189

The work on statistical mechanics by Ralph Fowler and his Cambridge group in the 1920s

Martin Niss
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In the 1920s, quite a few scientists began to apply statistical mechanics to a variety of phenomena not previously explained with this physical theory. Some of these were considered to be of a quantum mechanical origin, such as atomic spectra, but many were more mundane phenomena of physics and chemistry, such as imperfect gases, solutions, crystals, conductors, surface films and liquids. In the subtitle of an influential 1929 book on statistical mechanics, statistical mechanics was presented as *the theory of properties of matter in equilibrium.* In the talk, the seminal contributions by Ralph Howard Fowler (1889-1944), the author of the book, and his group at Cambridge will be presented as an example of this movement of treating new phenomena. The basis of the groups work was a new technique (the Darwin-Fowler technique) developed in 1922-23 by Fowler and his colleague C. G. Darwin, which allowed the treatment of many such phenomena, including dissociation phenomena of chemistry and physics and imperfect gases. In the talk, the contributions of the group in this respect as well as their influence on subsequent developments in physics and chemistry will be studied.

Symposium (Part 1/2) Science and empire in the age of global history (Science and Empire Commission) - ID 538

Contribution ID: 828

What can we learn from decolonial perspectives on colonial / decolonial sciences ?

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In a first part, I will come back to the multiple origins of the network (then commission) "Sciences and Empires" in the historical and academic context. Beyond the studies that refer to it, a common vision of science (from Bernal and Needham) guided the analysis of the role of science in imperial and colonial

policies, with a certain level of opposition to the Eurocentrism.
In a second part, I will seek to identify what were its limits, contradictions and worldview, such as: the violence inherent in colonization; the centrality of the race, as a "natural" element in this process; legitimization through science; the radical opposition between science and traditional knowledge; Western modernity and its universalism as a path to be followed by all countries; etc.
In a third part, I will be interested in the tools and concepts of decolonial studies which are the most relevant for "Sciences and Empires", such as: the deconstruction of capitalist modernity and the westernity of the so-called "modern" science; criticism of abstract universalism, to which a "pluriversal" is opposed; the relevance of traditional knowledge, particularly in the face of the ecological crisis; etc.
In a fourth part, I will come back to my study (2009) concerning a chemist of French born, settled in the Amazon, Paul Le Cointe (1870-1956), who was a geographer, naturalist, economist and above all initiator of plant chemistry in Belém . A decolonial approach provides new insights into his works.

Contribution ID: 721
Epidemics, Public Health and Empire: Experiences of Colonial India

Deepak Kumar
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In view of the recent corona virus pandemic, health concerns have suddenly jumped centerstage in all public discourses, policies, actions, and even private conversations. People have begun to talk about life before corona and after corona in terms of BC and AC! Epidemics have always been part of human history and have caused massive deaths and colossal socio-economic dislocations through the ages. Empire as a relatively new form of rule had probably intensified the arrival and impact of epidemics. British India was no exception.
Colonialism was no philanthropy nor are other forms of governance. The agents and the apologists of the colonial state had given the state a clean escape from any public health responsibility. Here one may ask, how 'public' was public health? Right from the mid-nineteenth century questions relating to public health engaged both the official and public mind in India and the debates gradually became more intense in the wake of major cholera and plague epidemics. It ranged from assertions of imperial altruism to allegations of colonial callousness. The present paper would try to understand the links between epidemics, public health and governance, not only as recorded in official sources and medical literature but also as reflected in the local accounts and the 'native' press.

Contribution ID: 948
Migration, plantation, empires

Cristiana Bastos
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My paper addresses the relevance of the science and empire approach by discussing the production of race and racial sciences in the context of imperial politics. I aim to go beyond the conventional equation of racialism being a child and a handmaiden of empire making and analyze the co-production of plantation as an economic system and racialism as a knowledge system. I will anchor the discussion in

the quintessential transatlantic trade in Africans towards the Americas and Caribbean and in later displacements into Mauritius from Africa and South Asia, plus the complex routes into Pacific plantations in Fiji, Hawaii and Australia , which involved the kidnapping of South Sea Islanders, and the indentured contracts of South and East Asians, Atlantic islanders, etc. I will extend the discussion into more recent settings involving industrial New England in the early twentieth century and the racialized politics of immigration in the United States; and the contemporary trends with large scale food production in Europe, analyzed as Plantation Europe, surviving on racialized migrant labor.

Contribution ID: 915

Of Mice and Snakes : a connected history of medicine in Brazil and India (1870-1914)

Matheus Alves Duarte da Silva
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This presentation aims to show the possibilities of a new history of the emergence of bacteriology through the connections between actors working in Brazil and India. To do so, we will retrace two global conjunctures and follow the actors who operated on it. The first conjuncture is a race to find a universal antidote against snakebites between 1870 and 1900. As it will be argued during the presentation, this scientific enterprise was in part animated by a stupendous - and apparently fake - prize from the Government of India for who would discover it. This then pushed a good number of scientists - Brazilians among others - to send their therapeutic inventions to Calcutta and Bombay, where they were evaluated. These antidotes coming from Brazil were varied, going from some herbs to sera and chemical products. The second conjuncture was created by the pandemic of bubonic plague and lasted between 1896 and 1914. During this moment, microbiological laboratories settled in Brazil tried to intervene in the scientific debate in India about the cure of the disease. At the same time, these laboratories imported and transformed some prophylactical practices developed first in the British colony, mostly in Bombay, applying them further in Rio de Janeiro and São Paulo. In brief, by examining these two processes, this presentation intends to contribute to the debates on the possible dialogues between global history and the history of science.

Symposium (Part 1/5) Re-scaling & de-centering the history of oceanography: the 'hidden figures' and hidden dimensions of global ocean science (ICHO) - ID 448

Contribution ID: 871

An 'Indian' ocean? Marine biology and scientific authority in British India

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How were relations between the 'local' and 'global' configured during the emergence of oceanography as a set of closely allied modern scientific disciplines? This paper will revisit this problem using the little-

known history of oceanographic and marine biological research in British India. Between the 1880s and 1930s, British naturalists in India, along with some Indian assistants and artists, conducted extensive surveys of the Bay of Bengal, the Arabian Sea, and large swathes of the northern Indian Ocean. Equipped with used gear from the *Challenger* Expedition, the RIMSS *Investigator* was deployed each year to conduct trawling, dredging and sounding operations, and the resulting marine biological samples and hydrographic data were processed in Calcutta and exchanged with numerous European research centres. As I will show, this motley group - especially Alfred Alcock, Nelson Annandale and Sunder Hora - were highly conscious of their distinct positions in imperial knowledge-production networks. Trained in Western metropoles and employed in the periphery, they claimed to face a form of double-marginalisation: from cash-strapped colonial governments skeptical about the practical benefits of oceanography, and from condescending researchers in Europe who saw them merely as sources for specimens and taxonomic minutiae. Their search for scientific authority, I argue, resulted in a series of constantly evolving strategies: recasting histories of early oceanography with forgotten pioneers from the colony, making a case for local expertise about life in the Indian Ocean against global expeditionary science, and advocating the intensive and recurring study of lagoons and estuaries as an allegedly epistemologically unique 'Indian' bionomics.

Contribution ID: 844

Post-War Reconnaissance of Japanese Fishery and Ocean Science and its Contribution to the Development of U.S. Scientific Programs in the Pacific: 1947-1958

Carmel Finley
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In November of 1947, three American scientists landed in Tokyo, tasked with investigating Japanese ocean science and tuna fishing techniques. Over the next six months, Bell S. Shimada, a recent graduate of the School of Fisheries at the University of Washington, would locate and interview leading Japanese oceanography scholars, and assist in translating their work for the newly created Pacific Oceanic Fisheries Investigation (POFI), a division of the U.S. Fish and Wildlife Service headquartered in Honolulu. The translations by Shimada and others greatly influenced "Progress in Pacific Oceanic Fishery Investigations, 1950-53." Authored by POFI Director O. E. Sette, the document pioneers the of integration of fisheries, oceanography, and meteorology to understand the dynamic structure of the equatorial Pacific Ocean and the importance of upwelling and frontal structures as they relate to tuna distribution and abundance. This paper examines the over-looked contribution of Japanese scientists to the structure of ocean science and the development of recruitment fisheries oceanography, defined as the impact of the environment on the annual production of young fished stocks.

Contribution ID: 784

Female Peruvian scientists in fishery science: The marine biologists of IMARPE, 1964-1982

Alejandra Osorio
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In the 1960s Peru became one of the leading fishing countries due to the increased fishing of the Peruvian anchoveta and the production of fishmeal. In 1964 a national institute of fishery sciences, the Instituto del Mar del Peru (IMARPE), was created to avoid overfishing. Its scientific program was designed and sponsored by the Food and Agriculture Organization (FAO). In a short time, IMARPE became a top research institute in Latin America. However, in 1972 the impact of the *El Niño* climate phenomenon and overfishing in the preceding years drastically reduced the anchoveta populations.
A group of women from the marine biology department was behind the scientific outcomes of IMARPE. During its first two decades, thirty female scientists worked in the institution. Notwithstanding their prominence, female scientists were subjected to numerous obstacles throughout their careers: they were not allowed to participate in research expeditions on open seas, and only rarely in international scientific congresses, seldom occupied leadership positions, and faced the challenge of balancing professional life with motherhood. Despite these barriers, many of these women became renowned specialists and the of relevant fishery science contributions.
This paper is based on scientific reports from IMARPE, as well as interviews with the female scientists. It aims to reflect on the role of women in the history of Latin American fishery sciences by highlighting their contributions and by pointing out the gender barriers many scientists faced.

Contribution ID: 843
Recovering hidden histories of marine and aquatic invasion biology

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Over the past two decades, biological invasions have attracted intense worldwide attention from funding agencies and policymakers due to the threats that non-native species pose to ecological and economic systems. However, like other subfields of ecological science, invasion biology retains a strong terrestrial bias. Many basic facts about how ballast water exchange systems and other forms of maritime infrastructure facilitate species exchange—especially in the context of global climate change—remain unknown, leaving human communities along oceanic and inland coasts vulnerable to potentially destabilizing waves of invasive organisms.
This presentation compares and contrasts two important yet under-researched episodes in the history of marine and freshwater invasion biology: the 1960s-70s effort to promote evolutionary and ecological studies of marine species exchange likely to be caused by a sea-level Central American canal, and the 1980s-90s initiative to document the presence and spread of non-native zebra mussels in the Laurentian Great Lakes ecosystem. Although the U.S. scientists who led these initiatives enjoyed many privileges, for a variety of institutional and disciplinary reasons they often struggled to attract adequate funding, and to overcome the longstanding assumption of the maritime industry that shipping had already intermixed the world's watery species to such a degree that expensive preventative measures made little sense. Examining their interlinked scientific and political failures and successes helps illuminate potential strategies for marine/aquatic invasion biologists today seeking to convince the public to support their research.

Session VI (Part 2/3) - Academies, Societies, Laboratories and other Institutions
Contribution ID: 1136

Nearly fallen giant: the case of the Russian Academy of Sciences, experiencing the impact of the new management reform

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In 2019, it was six years since the last reform of the Russian Academy of Sciences (RAS) began. During the reform period, RAS employees actively spoke out against changes in its structure and operation. At the end of 2019 we conducted a virtual anonymous questionnaire survey of 267 employees of the Russian Academy of Sciences who hold various positions (both scientific and administrative) in RAS institutes across the country. We managed to get cross-section opinions of RAS employees regarding the dynamics of changes in their financial and legal status during the reform years, as well as the conditions for scientific activities in the country. The structure of the questionnaire allowed to assess the degree of scientists' involvement in the reform processes, as well as their readiness to engage in a dialogue with new management authorities on the implementation of the new reform. The results showed a highly negative attitude of RAS employees towards the reform, expressed in the notable shortage of resources (including reduced financial security and increased time and labor costs for bureaucratic activities). The majority of survey participants admit considering the reform phase to be an "almost fatal blow" for the RAS, and seeing the implementation of a new reform under the leadership of scientists themselves as the only way out of the situation.

Contribution ID: 1196

Emergence of Scientific Community in India: Role of Indian Science Congress Association, 1914-1947

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The paper aims to assess the role of Indian Science Congress Association's (ISCA) in the emergence of scientific community in India during 1914-1947. The study seeks to address the blatant gap in STS and history of science literature on scientific institutions, primarily professional associations and their role in the evolution of a scientific community, which lay at the core of professionalisation of science. The paper discusses the absence of community consciousness among the scientific workforce as a result of problem part-time scientific workers and expatriate scientists in India during the early decades of twentieth century. The study is largely based on archival research and analyses ISCA's proceedings and biographical material pertaining to its members. It aims to understand what roles ISCA played in developing a community consciousness among the scientific workforce, geographically scattered and isolated due to specialisation. The Congress through its annual meetings in different parts of India and across varied disciplines of science, helped in mitigating both these forms of isolation within scientific workforce. It evolved as the Congress of savants and became a forum for 'who's who in science'. ISCA has played a pivotal role in transforming the 'small, elitist Bengal-centric' community into a larger all-India community of scientists belonging to varied disciplines and sub-disciplines. ISCA also provided a platform for greater communication with scientists abroad and emerged as meeting ground with foreign scientists from various associations and academies of science across the world attending ISCA's annual sessions.

Symposium (Part 1/4) The materiality of knowledge circulation between China and Europe: physical formats, epistemic genres, spatial localities (16th-18th century) (ISHEASTM) - ID 31

Contribution ID: 655

Towards a Cross-Cultural History of Eurasian Medicine: The State of the Field

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Recent research has highlighted the exchange of medical concepts, practices, and objects, such as items of materia medica, that took place between Europe and Asia in the First Global Age (16th-18th centuries). This research suggests reconsidering any firm boundaries between the medical cultures of Europe and Asia in the period from the late middle ages to the early modern age. The Mongolian expansion westwards and the spread of Islam eastwards were decisive factors for the creation of new areas of contact between Eastern and Western medical cultures. A crucial aspect of this process of medical hybridization was the eastward diffusion of Greco-Islamic medicine beyond the Middle East, into South Asia and East Asia.
In this paper, we will review, in a preliminary and exploratory way, the literature on this issue in Western and Eastern historiographies, with particular attention to U.S. and European contributions, in one case, and Chinese and Japanese , in the other. Our goal is to examine the current shift in historical research from an "area studies" approach, where Europe and Asia are studied separately, towards a "connected history" framework, focused on the coexistence, co-development and interaction of Eurasian medical cultures.

Contribution ID: 281

Xu Shizhi and pulse diagnosis in eighteenth-century Naples

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This paper argues that the practice of pulse diagnosis by a Chinese physician in Naples as well as the theory brought back from China by European missionaries may have influenced European understandings of the pulses. It uses hitherto unstudied correspondence relating to Xu Shizhi (Caietanus Xiu 1748-1801), a Chinese doctor who practiced in Naples from 1773 to 1778, preserved in the archives of the college for training Chinese in Naples (now the Università Orientali di Napoli). These letters read in conjunction with information about Xu's background in China enable us to investigate responses to Chinese pulse diagnosis among Neapolitan elites. Xu, who came from a remote town in northwest China, had studied medicine in China, and when he arrived in Naples to study for the Catholic priesthood he was drawn by interest and enthusiasm for his knowledge into practising there as a doctor. He became known in Naples especially for his skills in pulse diagnosis. As a result he met and treated many eminent members of Neapolitan society including the wife of the prime minister Bernardo

Tanucci. Xu also came to know Domenico Cyrillo whose work on the pulses (*Tractatus de Pulsibus*,1802) contains a chapter on Chinese pulse diagnosis which appears to have been influenced by Xu's practice as well as by the written sources available at this time.

Contribution ID: 53

Tactility, pulse, and body knowledge in transit: John Floyer's reading of diagnostic touch in English and Chinese medicine

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This paper addresses the early modern encounter of two different finger techniques originated respectively from traditional Chinese and European pulse medicines. From the late seventeenth century onwards, serious investigations of Chinese pulse diagnosis began to be transmitted into the community of English intellectuals and aroused their intense curiosity, whose climax may be marked by the publication of the Lichfield-based Oxonian physician John Floyer's (1649-1734) *The Physician's Pulse-Watch* (1707 and 1710). In this treatise ambitious to provoke practitioners adopting new manual manners of taking the pulse, it is striking however to see the absence of relative illustrations. Yet, tracing Floyer's media of learning Chinese medicine back, we find many images of pulse-taking hands in his reference literature. This paper focuses on these images and their corresponding textual explanations, and inspects the fluidity and integrability of tactility and body knowledge embodied in them. It will argue that the negotiation of the two finger techniques sets a vivid example revealing the significance of materiality in allowing pre-modern cross-cultural exchange of ideas. While the body knowledge of the pulse in two distant medical cultures remained quite diverged, the diagnostic hands in act overlapped and concocted. The lack of full understanding of Chinese pulse medicine, both in practice and especially in theory, intriguingly became a crucial drive for Floyer's claim of the superior rationality and usefulness of the pulse in European medical context. His reading and textualised reproduction of those instructive pulse-taking images, as this paper will show, prompted this effort while also constraining it.

Contribution ID: 79

Crustaceans, crosses, and cures

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The presence of crustaceans in the 17th-century Jesuit accounts of China is intriguing.
A crab miraculously returned the cross Francis Xavier had immersed in the water to calm the stormy seas. Crabs with crosses on their shells reportedly appeared off the coast of China when several members of the Ming emperor's household converted to Catholicism. The Jesuit missionary Michael Boym interpreted these apparitions as divine signs that the Ming dynasty would overcome the current misfortunes and be victorious over the Qing usurpers. He also believed the baptisms to be a sign that the authority of Pope Innocent X would extend over China, thus fulfilling the medieval prophecy that the papal influence would reach the Tropic of Cancer.

In addition to their spiritual value, the Jesuit narrative also mentioned the therapeutic virtues Chinese compendia of *materia medica* attributed to crabs. Michael Boym, François de Rougemont, and other missionaries noted in their correspondence the curative effects of stone-crabs, a species of crabs that turned to stone when taken out of the water. When news about these petrified crabs appeared printed in Europe, they were considered 'marvels of nature.'
Focusing on the crab case study, this paper aims to discuss how China Jesuits used maps, letters, and book manuscripts to convey natural and medical knowledge to their European audiences.

Symposium Histories of materials: biographies, institutions, tools, across scale - ID 384

Contribution ID: 971
Biography of materials

Bernadette BENSAUDE-VINCENT
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Materials such as glass, steal, carbon, silicon … are invisible actors of scientific and technological developments. The knowledge and know-how about materials play a key role in technological advancement. However historians of science and technology pay little attention to the role of materials. Despite the "material turn" in humanities, anthropologists and archeologists are more concerned with the social life of things than with the materials they are made of. On the basis of a few examples, I will argue that materials have a life of their own, different from technological objects and commodities. The overall purpose is to better understanding materials *as natural entities and sociotechnical agents in the history of technology.*

Contribution ID: 979
Across scales in materials research

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Through the lens of scale, as broadly defined across length, time, and volume, this paper focuses on the relationships between the structure, property, performance, and processing in materials as characterized and employed across scales in historical context. It analyzes the history of materials research and development methods in characterizing, synthesizing, designing and employing materials across scale in both physical and computation space, and bridges the context of laboratory and broader built environment. This approach prompts us to ask questions about the social context and values that are embedded within and co-constructed by these processes, and properties themselves. How might thinking with materials across scales from computational modeling of nanostructured concrete, to the design of structures for graceful failure help us to better understand strength and resilience?

Contribution ID: 921
Tools in the History of Materials Research

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The science of materials has contributed to changes in our civilization as pervasive as they are profound. The ways we travel, communicate, wage war, build buildings, dress, heal, play sports, read, listen to music, use energy, and care for the young, the old, and the vulnerable have all been shaped and reshaped by our knowledge and mastery of metals, semiconductors, organic and biocompatible materials, gels, plastics, polymers, plasmas, and other substance. Laboratories dedicated to studying and manufacturing materials proliferated in the twentieth century. They were sponsored by governments, assembled within universities, and established by industrial firms. They reformed our understanding of matter and changed the material profile of our technological world because a diverse assortment of tools was successfully coordinated within them. Imagine walking into one of these labs—at Cornell University, or the Centre National de la Recherche Scientifique, or General Electric—in the 1970s or 1980s and looking around. You are surrounded by a wide assortment of tools. Some—glass flasks and beakers, thermometers, microscopes—have been shaped by centuries of development and modification. Others, particularly those taking advantage of various scattering and diffraction phenomena, are recent developments. Still others are so unassuming that you might not register them as tools at all, from the trade catalogues that researchers use to browse new prefabricated materials and equipment, all the way up to the building itself, which was designed to instrumentalize the interactions of the researchers within it. This talk explores the themes that bind their stories together.

Symposium (Part 2/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 205

Contribution ID: 284
Crossing the boundaries between instrument makers, science, and industry

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History of Science Working Group - Ernst-Haeckel- Haus, Friedrich-Schiller-University Jena, Jena, Germany

The department for measuring instruments of the Carl Zeiss company in Jena connected users from the most diverse social spaces in a unique way. As a result, the department formed a central node within a network of 'lead users.' In intensive exchange with these lead users, classes of instruments were adapted to the differing needs of the varying user groups. Until the Second World War, the main products consisted of refractometers, interferometers and spectroscopes. The department was founded in 1893 as a spin-off of the increasingly scientific development and production of microscopes. Before its foundation, the main task in this context was to measure the refractive index and dispersion of different types of glass for microscope production. For this reason, the first instruments were refractometers that were used for glass analysis. In the following years they were adapted to various other applications.

While in the beginning generic refractometer types were manufactured, these types were refined for specific purposes towards the end of the 19th century in close cooperation with the users. Later interferometers and spectroscopes followed. In my talk I will use selected instruments from this department as examples to investigate how these instruments changed in the circulation process between the different spaces and how the actors - instrument makers and users - actively promoted these changes. The talk transcends my former case study of interferometers to a broader view of the activities of the Zeiss' department for measurement instruments.

Contribution ID: 478

From Paris to Prague: Precision Tuning across Boundaries

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In 1921, the Czech phonetician Josef Chlumský went to Paris to supervise the fine-tuning of thirteen tuning forks for speech research modelled on Abbé Rousselot's collection at the Collège de France. Twenty years earlier, Rousselot had purchased Rudolph Koenig's Grand Tonometer, the most extensive series of precision tuning forks produced in the 19th century comprising hundreds of instruments and a vast range of frequencies. Replicating Koenig tuning forks involved an investment in precision that required months of repetitive tests and fine-tuning in the Collège laboratories. These processes entailed extensive training of the ear, collaboration with technicians and instrument makers, and verification by speech acousticians from the Paris laboratory. Well into the 1930s, Chlumský supervised the making of a full replica of the Paris Tonometer (often remotely), which he and colleagues in Prague continued to use and calibrate into the 1940s. By comparing archival laboratory notes with surviving instrument collections in Paris and Prague, our paper explores the inner workings of these acoustical laboratories revealing the movement of objects and practices across multiple boundaries – between artisanal and laboratory spaces, disciplines, nations, and scientific cultures. The Paris-Prague connection contributed to a larger international network of instruments and practice from Paris to Japan, with impact far beyond laboratories' walls. These experimental activities were part of contemporary efforts to refine national identity through speech studies, and carried this particular culture of precision into other areas of sound studies, from dialectology, to hearing loss evaluation, to education.

Contribution ID: 1078

Denis Papin's Digester: a European history

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The *digester*, invented by Robert Boyle's experimental assistant Denis Papin in the 1680s, is a pressure-cooker-like device useful to soften hard bodies – mostly bones – by boiling them at high pressure. Several historians have pointed at the digester's failure to permeate European technical culture, and to become a steady support for everyday practices. Whereas, in fact, the digester circulated widely throughout Europe from the end of the seventeenth to the mid-nineteenth century. The device was

reappropriated and reshaped in various socio-cultural contexts to serve manifold purposes, including chemical experiments, and large-scale preparation of meals. In this paper, I aim to show that the digester has had a relevant place in the history of scientific and technical innovation. I thus intend to contribute to an object-centered HST, focused on materiality, its circulation and its role in shaping practices. After discussing Papin's own work on the digester, I will present the eighteenth-century European reception of this machine, taking into account several manuscript and printed sources from France, England, Switzerland, Italy, the Netherlands, Germany and Sweden. The key-issues I will address are: (a.) the manifold contexts of use and functions of the digester; (b.) the variety of values associated with the digester, such as precision, velocity, economy and safety; (c.) the debates over the expertise that a practitioner had to have in order to manipulate the device. In so doing, I also wish to assess whether Papin's initial views on the digester and its functions were respected, modified or overthrown.

Contribution ID: 272

From steam engines to equatorial telescope mounts: Controlling power and crossing boundaries from 1780 to 1860

Richard Kremer
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In his 1852 description of apparatus for astronomical observatories, London instruments maker William Simms suggested that clock drives for new large telescopes "resembled in some respects the governor of a steam-engine." This paper will examine how a technical object crossed boundaries, moving from an industrial factory to a precision machine shop to large astronomical observatories and finally to theoretical domains of mathematical physics.
In the 1780s, Watt developed the "flyball" centrifugal governor to control the speed of steam engines. Seeking to copy English industry, the Bavarian state in 1791 sent a young military engineer, Georg Reichenbach, to London where he worked in Watt's factory. Reichenbach's industrial espionage led to his opening a precision machine shop in Munich, where he built first machine tools and then precision scientific instruments, including clock drives for large equatorial telescope mounts that embedded Watt's flyball in a different technical system. In the 1820-30s, Reichenbach's clock drives enabled a new generation of "giant" refractors to follow the moving sky and a new generation of astronomers to start conducting natural history of the cosmos. Not until the 1860s would theoretical physicists such as Maxwell and Foucault analyze the mathematics and physics of the governor. The post-1860 story of centrifugal clock drives has been nicely told by Darius-Thomas (1989) and Caplan (2012). This paper will add industrial roots to their stories and will track industrial knowledge as it left the factory and moved into regimes of precision in the astronomical observatory and theoretical physics.

Symposium Sources and resources in history of science: does size matter? (CBD) - ID 329

Contribution ID: 925

Revealing the invisible: human versus computational approaches to bibliographic discovery

Stephen Weldon
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The database that powers the IsisCB Explore system is a linked network of persons, institutions, publications, and topics that provides a multi-dimensional, relational model of the discipline of history of science. In this paper, I will explain how I have begun to work with the IsisCB database in conjunction with full text and n-gram data from a large corpus of citations in JSTOR. My goals are two-fold. First, I seek to understand how well computational tools fair against manual classification and tagging: What are the benefits to each method? Second, can we use this knowledge to better understand and calibrate big data tools by using the existing manual system to train the algorithms? If we isolate the known topics, can we increase the usefulness of these tools in ways that will help us to discover new topic areas? This effort will be applied to a few test cases, including African Americans in science, alchemy and chemistry, and pandemics. I hope to show that this approach will allow us to identify small, hard-to-see topics in the literature of the discipline—the dwarfs among the giants—and bring them to light for closer study.

Contribution ID: 401

Object and objectivity: archives as interpretation

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Archives enable diverse stories. This aim shapes the purpose of an archive and what environments it could nourish in the future. This diversity, of course, only possible if we probe the foundational structures of archives and the histories that get narrated. In this discussion, we revisit often-asked questions within the context of both decentralized and top-down internets: what's an archive, and to what end? Where does the archive (or story) begin (or reside, or end)? Whose material enters the archive? For whom does the archive exist? Who describes the archive? Who does the archive get built by? Who interprets the archive? When does curation become the archive?
At the heart of an archive – both for the archivist and for the user – is an attempt to find meaning in the data stream. And the questions above hint at understanding the connections between memory, database and the narrative.
At the Archives at NCBS, a new space for the history of contemporary biology in India (http://archives.ncbs.res.in/), we are undertaking a collaborative project on annotations. At ICHST 2017, we shared our initial work on revisiting institutional narratives using open source digital tools (http://stories.archives.ncbs.res.in/exhibit/13ways/). In this talk, we build on that work and show a template for a consortium of science archives with three meshed spaces: discovery (a catalog of catalogs), interpretation (annotation tools), and narrative (storytelling widgets).
Disclaimer: This talk is an edited version of previous presentations of the work in the Archives at NCBS.

Contribution ID: 403

A fragment of the dissemination of the history of science in the Baltic States - the conference Scientiarum Baltica

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The initiative to bring together historians of science from Baltic Countries took place in Riga in 1958. Prof. Paul Stradiņš (1896–1958) organized a joint meeting for historians of science from Latvia, Estonia and Lithuania. A program for future joint activities was developed, and the tradition of joined conferences *Scientiarum Baltica* in each country followed. From 1991 Baltic Association on History and Philosophy of Science (BAHPS) (uniting independent societies of Estonian, Latvian and Lithuanian historians and philosophers of science) took over the conference and also coordinates the dissemination of information on scientific heritage in Estonia, Latvia and Lithuania. The Finnish Society for the History of Science and Learning joined the BAHPS in 2012.
The paper aims to present an overview of published outcome of the conference. Survey will be based on the annotated bibliography of the conference (1958–1985) and book series on history of natural and technical sciences in Baltics (1968–1991), Acta Baltica Historiae et Philosophiae Scientiarum (2013- , found at: http://www.bahps.org/acta-baltica) etc. and will show the main trends in subject, institutional and country presentation.
The location of hard copies of conference material will be performed, supporting the idea to archive scientific ideas for further investigation.

Contribution ID: 428

Big data management and visualization: how can dwarves find a place among giants?

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Computational and big data-driven approaches are increasingly applied to many areas of the Humanities. These developments are beginning to yield novel insights, however, some hints strongly indicate that successful computational and big data approaches require specific adjustment not only to the heuristics and hermeneutics proper to the Humanities, but also to coordinate institutional resources of different type and size.
In this talk we will address challenges related to the management and visualization of big data specifically for studies on history of science. More in particular, what conceptual and technological solutions may can be developed to manage and visualize such large datasets and to test the resulting tools in actual research through case studies. As is known, studies on history of science require conceptualizing the dynamics of knowledge as transformations within a set of interconnected networks, and to connect time series of network patterns with dynamical models that can test specific causal hypotheses.
This process involves technical solutions and also acceptance and sharing across the larger social network. Within such context, smaller institutional resources are often eclipsed by the larger ones. Yet, we argue, smaller institutional resources can gain visibility when highly specialized—e.g. general vs.

field-specific libraries. Nevertheless, tailored digital tools are still needed to integrate such institutional resources.

Symposium (Part 3/3) The Greek and medieval Ptolemy (CHAMA) - ID 90

Contribution ID: 168

Greek texts by and related to Ptolemy recovered from the late antique palimpsest Ambrosiana L 99 sup.

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The "Palimpsests and Multispectral Imagery" project is applying ultraviolet and multispectral imagery technology to the decipherment of the underlying texts of a palimpsest manuscript (Veneranda Biblioteca Ambrosiana, L 99 sup.) in ancient Greek with astronomical and mathematical content. The astronomical texts include twelve pages from Ptolemy's Analemma, which were identified and substantially but not completely transcribed by J.L. Heiberg in the 1890s, but also twelve pages from which only brief passages have hitherto been transcribed, and which cannot be matched with passages in William of Moerbeke's Latin translation of the Analemma. We have identified two distinct texts: four pages whose subject matter also relates to analemma constructions, and eight pages concerning an armillary instrument that might be Ptolemy's nine-ring Meteoroskopeion. Our paper for the 2021 ICHST will be a provisional report of our work on these three texts.

Contribution ID: 376

The Ptolemaic Analysis of the Hipparchian Lunar Model

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The presentation aims at casting some light on what must have been, to ancient astronomers, one of the most interesting aspects of tables, that is, their potential to analyse the predictive errors of a model, uncovering the theoretical variables on which it depends, thus paving the way to build newer and more accurate models. I will show this using as an example the development of Ptolemy´s lunar model in his Almagest. In Almagest V, Ptolemy explains how to modify Hiparchus´ lunar model in order to account for the errors he found in an analysis he made on it. This is not only is one of the few stances where Ptolemy gives us some hints of his steps towards a final model, but it is also one of the more complex models he ever presents. I will show a possible path Ptolemy might have taken to understand the behaviour of the error, and how astronomical tables could have been the main tool used to carry out such work. Thus, by showing how the tables work in the context of a very complicated investigation, the

lunar model serves as an excellent case to argue for the importance of tables in the developmental stages of Ptolemy´s system.

Contribution ID: 782

The gravitational influence of Jupiter on the Ptolemaic value for the eccentricity of Saturn

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The gravitational influence of Jupiter on Saturn produces, among other things, non-negligible changes in the eccentricity of Saturn for the magnitude of error of Ptolemaic astronomy. The value that Ptolemy obtained for the eccentricity of Saturn is a good approximation of the real eccentricity – including the perturbation of Jupiter – that Saturn had during the time of Ptolemaic planetary observations or a bit earlier. Therefore, it seems more probable that the observations used for obtaining the eccentricity of Saturn were done near Ptolemy's time, and rather unlikely that earlier than the first century BC. Even if this is not quite a demonstration that Ptolemy used observations of his own, my argument reasonably increases its probability and practically discards the idea that Ptolemy borrowed the values or the observations from astronomers beyond the first century BC, like Hipparchus or the Babylonians.

Contribution ID: 110

Ptolemy's tradition of astronomical tables in the Islamic world

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Ptolemy's tables as included in his *Almagest* and *Handy Tables* stood at the basis of a tradition of Islamic astronomical handbooks with tables (in Arabic and Persian called *zīj*es) that lasted for nearly a milennium and produced more than 200 works that are still extant in manuscript form or are known from references by later Islamic . This presentation will use the example of the *Comprehensive Zīj* (*al-Zīj al-Jāmi*ʿ) of the 10th/11th-century Persian astronomer Kūshyār ibn Labbān to show how the layout and contents of Ptolemy's tables were gradually replaced by more convenient and more accurate tables without giving up the most typical characteristics of Ptolemy's implementation of his geocentric geometrical planetary models.

Symposium (Part 1/6) Transportation History: Solving problems or creating bottlenecks? Railway history in political and economic context (ICOHTEC) - ID 10

Contribution ID: 576

Engineers vs political and financial stakeholders in Portuguese railways: a sociotechnical approach to a peripheral nation (1850s-1910s)

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In the 1850s, Portuguese technocrats agreed to put investment in science and technology before sterile ideological disputes. Benefitting from the adherence to the gold-standard in 1854, Portugal began an ambitious public works program, spearheaded by railways. Until 1900, the main branches of the Portuguese network were built (Alegria 1990). Historiography about Portuguese railways usually considers the rationale behind them as entirely technological and focuses mainly on their outputs, taking railways for granted, or black-boxed. However, the planification of large transportation systems depends on the sociotechnical context and on coeval hierarchies of power (Latour 1999; and Kranzberg's Fourth Law – Kranzberg 1986). In this paper, I propose to open the black box of Portuguese railways. I use technical reports, parliamentary debates, and sundry bibliography to analyse the influence different system-builders (Hughes 1983: X), like engineers, army officers, policymakers in central government, and corporations had in the design of the network. Specifically, I focus on the input of Portuguese engineers (most with previous engagement with Saint-Simonianism – Matos 2009) and compare it with the lobbying of decision-makers at central government, local caciques, and private financiers. I claim that engineers played a decisive role in the planning of the network, but a large part of its design was due to non-technical issues, including political machinations, budgetary constraints, and corporative lobbying. I aim to add to the debate about the co-construction of society and technology, the importance of social factors to technological implementation and how technology is a sociotechnical construction (Hackett et al. 2007).

Contribution ID: 623

Building Critical Infrastructure in the Past: The Railway Line St. Petersburg – Riihimäki in the 1860s

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The concept of *infrastructure* is more than 145 years old, and that of *critical infrastructure* has been in use for a quarter of a century. The latter is used by governments to label material and virtual assets or systems, which are vital for the function of the economy and society as a whole. In 1996, US President Clinton founded a national commission on *critical infrastructure*. It is regarded that this commission was the first to define "*critical infrastructure*". This paper claims that governments employed a similar way of thinking much earlier – even in the 19th century, although the concept was not in use at the time.

In the 1840s, Russia launched ambitious plans for constructing railways from the capital to various parts of its vast realm. This paper examines the case of Finland in the Russian Empire in 1809-1917. The Finnish government resisted the Imperial plan to connect Helsinki and several other cities in the grand duchy to St. Petersburg by railway lines. As a pretext, the senate at first emphasized that it should complete the construction of canals before opening railways. The Finnish government did not oppose railways as such. It disliked the idea to build a railway network compatible with that of Russia, applying Russian technical standards. The senate aimed at a national railway system, according to Western

European standards. The Russian government considered that all broad gauge railway lines should be compatible with those in the core of the Empire, to promote military, administrative and economic security.

Symposium VII (Part 1/2) Collaborations and Rivalries in the History of Mathematics (ICHM) (with IMU) - ID 84

Contribution ID: 164

"If I have seen further": the fortunes of Newton and Hooke in the accepted narratives of the Scientific Revolution

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Hooke has been often contrasted to Newton and Huygens as a practitioner and unfavorably compared to a theorist, or a as a "mechanic of genius rather than a scientist" (Rupert Hall). In my talk I will reflect on the reasons that led to the eclipse of Hooke from the narrative of the scientific revolution and how recent historiographical trends made possible what Lisa Jardine called a "restoration of Hooke's reputation." Lately, there has been a proliferation of studies on Hooke and, in the context of this congress, it is fitting to ask why Hooke's fortune has changed recently. There is no easy answer to this question. The fact that Hooke is given pride of place in recent accounts of seventeenth-century natural philosophy is consequence of a re-evaluation of the role played by engineers, mathematical practitioners, and "mechanicians" in the development of early-modern science, and of a shift of interest from mathematics and astronomy (the two disciplines that informed the Koyrean and Sartonian narratives of the scientific revolution) to mixed mathematics, hydrology, pneumatics, biology, medicine, microscopy, geology, and alchemy. But perhaps, even more deeply, our perspective has changed because of the recent advent of new scientific paradigms dominated by computer simulations and performative technologies. Theoretical physicists, such as Einstein and Dirac, are no longer dominating the image of science that so powerfully influenced historians of science belonging to the generation of Koyré.

Contribution ID: 119

The Sailor and The Savant: The ebb and flow of a scientific partnership

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Of all the students who learned from the *Cours de Géométrie Supérieure* given by Michel Chasles (1793-1880) at the Faculté de Paris, only one went on to contribute to the theories developed in them, namely Ernest de Fauque de Jonquières (1820-1901). And yet, De Jonquières almost never set foot in Chasles' classroom: he was an active naval officer, bound for a successful military career which took him all over the world as a representative and enactor of French imperialism in places such as

Mexico, Indochina, or Sierra Leone. Aboard his vessels, he would read the notes provided to him by some other students of Chasles', and soon enough, produce his own results. During his infrequent returns to Paris, De Jonquières even attended meetings of the Académie des Sciences, where Chasles was a regular and well-respected speaker, and occasionally communicated the results of his remote student's.

This tutelage came to an abrupt end in 1866, when De Jonquières, having reached sufficient prominence so as to be able to present results in his own name during a meeting of the Académie, was directly criticized by Chasles for having disrepected the latter's priority on a specific scientific matter. The two geometers had a public fallout, publishing open letters and pamphlets attacking the other's professional and ethical conduct as well as mathematical proficience.

In this paper, we trace the evolution of De Jonquières' self-styling as a student of Chasles, and the subsequent need for a deconstruction thereof in a context of public controversy.

Contribution ID: 135

Felix Klein (1849-1925) and Georg Pick (1859-1942): support and a (largely unknown) attempt to co-operate

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Felix Klein and Georg Pick: Collaboration and Support
Klein, a giant in the field of mathematics, needed cooperation. He brought young researchers from numerous countries into his sphere. His collaboration with the Austrian Pick, who was born to a Jewish family, is largely unknown and interesting in several respects.
I. Already in 1884, Klein recommended Pick for a professorship, who had lectured in his research seminar (1883/84; 1884) about Poincaré's article in *Acta Mathematica* (vol. 1), and other topics; had produced new results in a direction proposed by Klein (the complex multiplication of elliptic functions), and published in *Mathematische Annalen*.
II. Klein persuaded Pick to edit his lectures on the theory of elliptic modular functions. They cooperated from 1885 to 1887, however, the final publication (Klein/Fricke [1890/92]) includes no hint on Pick's editorial work. Why is this?
III. Pick is famous for *Pick's theorem* for determining the area of lattice polygons, which he first described in a paper on Geometric Aspects of Number Theory (1899). Pick referred in this article to Klein's geometric interpretation of continued fractions from 1895.
IV. Pick continued to publish in "Klein's" Annalen, and he followed Klein in other respects too. As Klein in Prussia, Pick was the first mathematician to supervise a woman's doctoral thesis in Prague (see Bečvářová 2020).
The lecture will make use of the unpublished letters written by Pick to Klein.

Contribution ID: 107

Ronald Ross and his 'capable assistant' Hilda Hudson: a collaboration on the mathematical theory of epidemics

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For several years Ronald Ross (1857-1932), who in 1902 had won the Nobel prize for his work on the transmission of malaria, struggled to complete a general theory of epidemics because he could not sort out the mathematics. In 1916 the Royal Society provided him with the help of Hilda Hudson (1881-1965), a talented Cambridge-educated mathematician who was then a lecturer at a technical college and whose research was in algebraic geometry. In this talk I look at their collaboration and how it has been treated in history.

Symposium Size matters: exploring the textual dimensions of scientific knowledge in four centuries of British publishing (DHST- DLMPST Joint Commission) - ID 491

Contribution ID: 606

'It is light, it is cheap, it is readable': volume, frequency and brevity in nineteenth-century medical journalism

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Within the fluctuating, financially volatile world of nineteenth-century publishing, medical journals were thrown into competition with one another. Doctors were considered by publishers and editors to be an unreliable audience, often too financially constrained or too busy to read or purchase medical journals. What then could be done to make medical periodical literature appealing? What did the doctor-reader require? This paper will interrogate how perceptions of volume, frequency and brevity impacted upon the production of medical journals. As medical journals proliferated, competing titles sought to offer ever more easily digestible content suited to the needs and desires of the overworked doctor. Innovative publications such as the *Lancet* and *Medical Circular* decreased issue size and published shorter articles but increased frequency through a weekly format, allowing them to capitalise upon episodes of scandal, sensation and medical controversy, publishing tantalizing editorials that promised more exciting content in the next issue. It enabled their editors to denounce rival publications which appeared as lengthy monthly tomes as ponderous and dreary. However, employing brevity - and its attendant effects of accessibility and readability - also left journals open to accusations of impropriety, particularly if they were seen to seek an additional non-professional audience. Ultimately, exploring this issue helps us understand publishers and journalists' ambitions to secure an enduring and engaged readership, and how this became embodied in the design and content of medical journals.

Contribution ID: 596

Big book, little book: sizing up mid-twentieth-century British biological books

Alex Aylward

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The descriptor "big" can mean many things when applied to a book. It might suggest the publication in question is especially important or influential in its field. It might instead suggest that the book is a veritable best-seller. Or it may simply mean that it is physically very large. (Very often, it is used simultaneously in several senses). This paper focuses on two biological books published in Britain in the middle of last century which were routinely discussed by their and readers in the language of "size": R. A. Fisher's *The Genetical Theory of Natural Selection* (1930/1958) and E. B. Ford's *Mendelism and Evolution* (1931/1934/1940/1945/1949/1957/1960/1965). The former—a hefty and densely technical scholarly tome—sold poorly and was not widely read. The latter was a "pocketsize" and accessibly written work which sold in vast numbers, going through many editions. Personal correspondence between the two reveals they saw their respective books as part of a common project of demonstrating the mutual compatibility of Mendelian genetics and Darwinian selection theory. Fisher's is today remembered and celebrated as the book which convinced the scientific community of this point, whilst Ford's has been largely forgotten despite its vastly larger readership. I examine the extent to which we can make sense of this differential fate—the contrasting legacies of Fisher's "big book" and Ford's "little book"—by attention to the language of "size" employed by the , and by their readers and commentators, at the time and since.

Symposium Museum revolutions? Transformations of science and technology display in Central and Eastern Europe since the 20th century - ID 386

Contribution ID: 460

E-POSTER Darwin in Moscow. Soviet Science Museums and the "Enlightenment of the Masses"

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This paper will interrogate the place of museums of science and technology in twentieth-century (Soviet) Russia, where materialistic sciences served a key ideological function for the state. My paper will take the history of the Moscow Darwin Museum as a starting point and embed it within the broader history of museums of science and technology in (Soviet) Russia. The Darwin Museum was a site of exhibiting science, and of science being conducted both by professional scientists (N. Ladygina) as well as those aspiring to one day become scientists (P. P. Smolin's work with the youth). Unlike the Moscow Zoological Museum, the Darwin Museum did not participate in experiments with the "brigade-laboratory method" that decentered the lecturer in the 1920s. Nonetheless, the Darwin Museum had to redefine its approach to museum work, the status of objects, and the narrative of Darwinism it presented in its exhibition repeatedly. This was at least in part due to increasing political pressures and oversight from the mid/late-1920s onwards.

"Darwin in Moscow" will examine the close relationship between the scientific community and museums, as well as the narratives of what constitutes science which the Darwin Museum and its peers presented. It will analyze the approaches with which Soviet museums sought to engage their audiences in their politically motivated desire to contribute to the "enlightenment of the masses."

Contribution ID: 501

E-POSTER Regional Industry, Interactive Exhibits, and Marxist History? Polytechnical Museums in East Germany

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In December 1955 Gerhart Ziller, a member of the East German Socialist Unity Party's Central Committee, announced plans to establish a network of „polytechnical museums" across the German Democratic Republic. Each of these museums was to focus on a branch of technology particularly important to the region it was located in. Primarily targeting youth, polytechnical museums' aim was to explain scientific principles, mainly through interactive exhibits, whilst also providing historical context. The term polytechnical referred to the educational philosophy of the same name, upon which the simulatenous reform of the East German educational system was based.
By the early 1970s, several towns in East Germany, such as Magdeburg, Pirna, Augustusburg, Dresden or Schwerin, played host to a polytechnical museum. However, by the 1980s only one such museum remained (in Schwerin) and the driving force behind their initial establishment, Fritz Leuschner, had to concede that his efforts had failed.
This paper will reconstruct the history of polytechnical museums in East Germany. Based on archival material and personal interviews, it traces the development of the idea behind these museums and takes a closer look at the exhibitions that were set up. Its central claim is that a need to emphasise Marxist theory fostered a highly innovative reinterpration of museums of technology, which was thwarted by economic and political restrictions.

Contribution ID: 443

E-POSTER Late and limited. The rebuilding of Berlin's science and technology museums in both parts of the divided city

Arne Schirrmacher
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Before the Second World War, the Association of German Engineers counted no less than 22 technical museums and collections in Berlin. After the war and the division of the city, almost all of them were either destroyed, relocated or "frozen", like the Museum of Transport, which fell into hibernation as it stood directly on the demarcation line. While museums in many German cities in East and West were renovated, expanded or newly established between the 1950s and 1970s, efforts to open science or technology museums in Berlin gained momentum very late. The Museum of Technology and Transportation in West Berlin did not open until 1983, and plans for a prominent science exhibit in East-Berlin did not materialize before the end of the GDR. In my talk, I will focus on the particular political significance each museum project acquired, as well as on the competition to claim science and

technology as achievements of the political system. Was it the case that neither side was able to find a suitable form of science and technology display, and thus, places for public debate and reflection on these crucial fields were long missing in Cold War Berlin?

Contribution ID: 629
E-POSTER From Museums to Centers: Exhibiting Science in Poland

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In Poland, later than in other West European and US countries, science centers were created. Although the Science Center Copernicus in Warsaw is the biggest and the most popular, there are many others, smaller and build thematically specific for the geographical region of their establishment and functioning. Questions appear: was/is the impact on development and on redesigning of exhibitions of the Polish museums of science and technology, do or how these two kind institutions cooperate, what was generally history and roots of the creation of science centers and science and technology museums in Poland, was this mechanism similar to other East and Center European countries? A few case studies will be analyzed. Attention will be given especially on the history and on the current state of the National Science and Technology Museum and Science Center Copernicus in Warsaw, as well on the science center in Cracow that is just under the creation and activity of other Cracow museums directed on interactivity.
Ewa Wyka
Historian of science, associate professor of the Institute for the History of Science Polish Academy of Sciences in Warsaw, curator of the Jagiellonian University Museum in Krakow. Area of research interests: history of mathematical and natural sciences, evolution of scientific instruments, aristocratic and academic scientific collections, making of scientific instruments, museology of science and technology, popularization of science.
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Symposium (Part 2/2) Science and empire in the age of global history (Science and Empire Commission) - ID 539

Contribution ID: 819
Scientific Research in Colonial India - Part 1: The Bombay Presidency

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The nineteenth and twentieth centuries in Bombay were a formative age for education and research in science, as in the other Presidencies. A colonial government, a large native population enrolled in the new European-style educational system, and the rise of several institutions of instruction and learning, fostered an environment of scientific research. The Asiatic Society of Bombay (1804), which was initially the hub of research in all disciplines, became increasingly antiquarian and ethnographic through the course of the nineteenth century. The Victoria and Albert Museum (conceived in 1855 and built in 1872), was established to carry out research on the arts and industry of the region. The University of Bombay (1857) was primarily tasked with teaching, and it was left to other establishments to conduct research. Key institutions were the Bombay Natural History Society (1883) and the Haffkine Institute (1899), which examined the role of plague that had been a dominant feature of the social cityscape from 1896. The Royal Institute of Science (1920) marked a point of departure, as it was conceived as a teaching institution but its lavish funding demanded a research agenda, especially at the post-graduate level. The Prince of Wales Museum (1922), would prove to be seminal in matters of collection and display of objects for the purpose of research. All of these institutions would shape the educational and intellectual debates in the city concerning higher education. Typically founded by European colonial officials, they would increasingly be administered and staffed by native Indians.

Contribution ID: 821

Scientific Research in Colonial India - Part II: The Princely States of Baroda and Travancore

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The princely states in India sought to emulate the colonial trappings of the Presidencies, particularly after the assumption of the holdings of the East India Company by the British Crown in 1858. These included the building of public libraries, hospitals, museums, railway stations, prisons, and a range of government buildings, emblematic of modernity in their alteration of urban settlements and redefinition of landscapes well into the 20th century. The princely state of Baroda in western India was one such, owing much of its renown to a single ruler, Sayajirao Gaekwad (*reg.*1875-1939), under whom three different kinds of holdings flourished (as in other princely states) – the fine arts, industrial arts and natural history. Scientific education also received a fillip through the establishment of Baroda College in 1881. Travancore in southern India had taken its cue even earlier, during the heyday of the East India Company (1757-1858), with the introduction of vaccination in 1813 under Rani Gowri Lakshmi Bayi (*reg.* 1810-1815). Before the Mutiny of 1857, a number of the types of scientific establishments that came into being in Baroda in the late 19th century had blossomed in Travancore under Gowri Lakshmi Bayi's successors, leading to the princely state being viewed as a model in the country. It must not be forgotten, however, that both states were essentially dependent upon British paternalism, militarily emasculated with the presence of protective colonial troops, and the manifestation of colonial opulence was at once an example of mimesis and weakness alike.

Contribution ID: 756

Did Kāśīnātha tarkālaṅkāra know sanskrit? recovering the thought worlds and practices of "brokers" in east india company india

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Historians of science have responded to the challenge of writing global histories of science by deploying new categories to analyze cross-cultural knowledge flows. Take the category of the broker, familiar to historians of colonialism and imperialism who study cross-cultural trade: the broker or go-between has been used as a capacious category by historians of science to accommodate translators, spies, teachers, preachers and healers. But to deploy the category of the broker is all too often to read the subject position of actors embedded in complex social relationships as always already brokers; and to reduce thick histories of their social and cultural practices to those aspects that facilitated their function as brokers.
This paper examines the history of Kāśīnātha Tarkālaṅkāra (fl. 1785-1801), a celebrated Bengali pandit, appointed the first Rector of the Benares Sanskrit College, founded in 1791. He collaborated with the famous British orientalist, Sir William Jones (1746-1794), but attracted the opprobrium of British administrators, who found him villainous and dishonest. The philologist, H. T. Colebrooke (1765-1837), meanwhile, disparaged his competence as a Sanskrit scholar. Reading against the grain of annotations by Colebrooke in Sanskrit manuscripts, and colonial reports, I recover the immanent logic of Kāśīnātha's intellectual and material practices to reveal the meaning context of his actions. I ask: does the category "broker" capture the nature of Kāśīnātha's relationship with British orientalists in East India Company India?

Symposium Wet ecologies: The media in (under)water worlds - ID 447

Contribution ID: 632
Imagining submarine and subterranean coral: Geology and the economics of marine fossil remains, Penny Magazine 1833

Anne Ricculli
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Historians have briefly commented on the reproduction of a portrait of ancient marine life based on "Jura Formation" (Goldfuss 1831) in an 1833 edition of Charles Knight's *Penny Magazine*. Scholars situate this media within early nineteenth century imaginings of prehistoric precursors of ocean fossil remains visible in Britain and continental Europe (Secord 1986, Rudwick 1992). In my talk, I argue that this penny press woodcut representing past underwater worlds served a broader purpose. I explore the overlooked goal of geological élites to address the general public in what contemporaries termed "cheap literature." My featured image is part of fifteen numbered series, written by a Geological Society of London member and designed to draw readers into conversation about the economic geology of marine fossil reserves. Leonard Horner cross-referenced his narrative to link local geological strata and historic ocean populations, indexed and numbered in the re-titled "Organic Remains Restored." Horner argued in 1833 – a full two years before the inauguration of the state-sponsored geological survey – that geologists, "possessing all the certainty of mathematical demonstration," located in the island nation stored economic wealth derived from coral limestone, a critical source of essential fertilizer and building materials in 1830s Britain. This penny periodical series mediated the formation of new economic relationships as Geological Society of London "giants" appealed directly to the post-Reform Act common

reader to endorse geologists' schemes to map and manage resources derived from inhabitants of current and historic ocean worlds.

Contribution ID: 850

Luminous marine animals and an enlightened public: How bioluminescence popularized marine biology

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Bioluminescence is an example of the connections between biology, physics, and chemistry, and simultaneously a field of research that caught broad public attention. Taking the existence of luminous marine animals into account, popular science publications increasingly emphasized marine species and their habitats since the 1860s. Reconstructed through text and images, scientists, popular science writers, and artists made these life worlds accessible to general audiences. Why did bioluminescence become a popular topic? And how did its presentation change in the course of that process? Approaching these questions through the lens of visual culture, this paper analyses the transformation processes that scientific knowledge underwent across different genres of publication. Using printed and archival sources, I will first trace how scientific imagery and the narratives they were embedded in changed to fit changing audiences. Second, I will discuss the rhetorical functions of different visual genres appearing across different popular accounts. My analysis focuses on marine invertebrates. While marine invertebrates were important for investigating the biological functions of bioluminescence, their visual representations produced in the course of field and lab research played a crucial role introducing the public to the diversity of marine life.

Contribution ID: 795

Live from the depths: Telepresence and the production of deep ocean science

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Telepresence is a generalized term that refers to technologies which allow people to be and act as if present at a place other than their actual location. It's development in the 21st century has influenced oceanographic research funding, expedition participation off and onshore, the concurrent balance of public narrative and academic science production, and the use and recycling of media products. This is primarily because, while scientific and public participation in oceanographic research via telepresence is becoming increasingly democratic, the ability to produce it is not. Though telepresence is a relatively new technology, its use is a modern manifestation of a long, robust history of incorporating artists, writers, photographers, and other documentarians in recording the production and scientific product of ocean expeditions. As in the past, the use of telepresence creates a narrative which includes "imaginaries" as part of the process of describing and explaining oceanographic science, but also creates excitement to, among other goals, keep eyeballs on the screen and perpetuate public interest in associated media consumption. This presentation discusses the integration of telepresence into oceanographic science and media production within this historic perspective.

Contribution ID: 668
Pteropods realized: From bio-indication to bio-inspiration

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Charismatic megafauna have dominated the rhetoric concerning marine degradation and conservation. Yet at the turn of the 21st century, as changing ocean conditions came into focus, a family of small marine snails sparked an explosion of scholarly work in the marine sciences. In this paper, I examine how pteropods—transparent, faceless gastropods only millimeters in size—progressed from scientific proxy, to the cultural embodiment of oceans in crisis, eventually emerging as an inspiration in both aesthetics and biomimicry. By combining analysis of archival materials, visual representations, and personal participation in, and observation of, an interdisciplinary research team, I trace how these charismatic microfauna made the leap from sea to shore, adorning journal covers, *National Geographic*articles, and art galleries as the poster-species for ocean acidification. Further, I argue that the scientific use of pteropods as bio-indicators led others, including artists and engineers, to portray the novelty, beauty and fragility of marine zooplankton in their own work, making the anthropogenic impacts of excess carbon in the atmosphere more tangible to mainstream audiences. Pteropods were not only "the right tool for the job" as bio-indicators (Clarke and Fujimura 1992; Bednaršek et al., 2014), they also emerged as bio-inspiration (Benyus, 1997; Shell, 2013; Murphy et al., 2016), making the cultural and political salience of ocean acidification possible (Daston, 2000). By examining the cultural significance of pteropods, this paper demonstrates the co-production of scientific practice, visual culture, and marine activism.

Symposium Colonial Science in the Pacific (Pacific Circle) - ID 634

Contribution ID: 972
Actor and Network in Science and Colonialism in the Western Pacific

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This paper uses actor network theory as a heuristic device to show how Charles Morris Woodford's life and work in the Western Pacific from the 1880s to 1916 qualifies him as a scientific giant. Woodford was a British naturalist, an explorer, a collector and colonial administrator. He had an interest forthe collection of fauna and adventure in unexplored territory of the Western Pacific. His collection of over 20,000 specimens and objects are held by British Museum of Natural History. Several animals, birds and species of lizards were named after Woodford. Woodford's experience expanded over time to the administration of law and government, initially in Gilbert and Ellice Islands (now Kiribati and Tuvalu), Samoa and then in the British Solomon Islands Protectorate. This experience provided Woodford with a broad base with which to create connections and networks with various actors thereby making him a

scientific giant and colonial administrator in the Western Pacific. The paper will draw on archival sources to show Woodford is uniquely positioned to be considered as a scientific giant.

Contribution ID: 953
Making Australian public scientists: measuring Victorian Scientific 'Giants' at 19th-Century Exhibitions

Peter Hoffenberg
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Paper 3. "Making Australian Public Scientists: Measuring Victorian Scientific 'Giants' at 19th-Century Exhibitions" (Prof Peter H. Hoffenberg, University of Hawaii at Manoa)

This paper explores the conference theme by asking how scientific 'giants' were made and made themselves in Australia, between the mineral rushes of the early 1850s and the Commonwealth's institutions of the early twentieth century. The focal point is how a scientist's stature was made or not as a result of participation at exhibitions in and outside of Australia. How was participation as scientists and representatives of scientific achievements and institutions, among the many criteria for what the CFP calls "the size of a scientific figure?" Participation provided a social status, some legitimacy and authority, and a way to measure the growth or stagnation of both the scientific figure and their particular contribution, or field. For scientists from individual colonies, one's professional status was also measured by contact with the larger outside world. Exhibitions came to the rescue in this case, as well, as participation on committees, personal visits and awards for exhibits connected the 'distant' Australian botanist, or geologist with the outside world. The exhibitions were the information superhighway and social media connections of the day, thus the paper concludes with some suggestions about the dynamic relationship between the scientific figures and the public role of science in Australian civil society. Resources include exhibition catalogues, government correspondence and reports, newspaper and periodical accounts, personal correspondence and memoirs, and scholarly studies about science and scientists in 19th-century Australia.

Contribution ID: 854
Comment

Hans Pols
School of History and Philosophy of Science, University of Sydney, University of Sydney, Australia

In my comments, I will reflect on the papers in this symposium and on colonial science in the Pacific.

E-posters (Part 1/3)

Contribution ID: 1060
E-POSTER Molecular terminology: the role of Euclid's Elements

Henk Kubbinga

retired, University of Groningen, Groningen, Netherlands

One of the undisputed Giants of the History of Science is Euclid of Alexandria (fl. ca. 295 B.C.), the most renowned mathematician who ever lived. An interesting indication of the broad influence of his celebrated *Elements* concerns rests of its terminology in fully unrelated fields: at Gymnasiums and Latin Schools, not to speak of the Universities, students were so imbued with the *Elements*' message that, once established as scholars in their own right, they borrowed words from it when they needed new technical terms sufficiently appealing to survive in the literature. In my paper I would like to discuss the first word used for what came to be known in due course as the concept of 'molecule', one of the fundaments of modern Natural Science: the inventor of that concept, Isaac Beeckman (1588-1637) called it 'homogeneum' (plural: 'homogenea') [1]. I intend to show the reason why he opted precisely for this term, with due reference to Definition 5.3 in the *Elements*' original Greek version as edited by Simon Grynaeus (Basel, 1533). Most unfortunately, the term didn't make it. The word 'molecule', as we know it, was a novelty introduced by Pierre Gassendi in 1636/37, a neologism without any history or connotation.

[1] For background reading see my *The molecularization of the world picture, or the rise of the Universum Arausiacum*, in 2 volumes, Groningen: Groningen University Press, 2009. See also 'The fourth centenary of the molecular theory 1620-2020', to appear in: *Bulletin of the History of Chemistry 2020*

Contribution ID: 1097

E-POSTER History of meteorological glossaries and dictionaries: collective effort and contribution of individuals

Miloslav Müller[1], Barbora Kocánová[2]
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Transformation of meteorology into a modern science at the beginning of the 20th century aroused need of codification of meteorological terms. Meteorological Glossary published in 1916 in UK was the first glossary of meteorological terms in the form of a separate volume. In France, Lexique Météorologique came out between 1926 and 1931. Both glossaries were compiled collectively by the staff of respective meteorological services. The situation was different in USA: Talman by himself collected more than 15,000 meteorological terms and Tiessen used some of them in his Weather Glossary (1946). Demand for adding terms with equivalents in other languages was soon perceived in Europe. In 1930s, multilingual dictionaries were published within the 2nd edition of Meteorological Glossary, as a separate volume of Lexique Météorologique and within the German Linke´s Meteorologisches Taschenbuch in 1933.
In 1950s, comprehensive glossaries were published also in German and Russian, both compiled by individuals (Keil and Chromov, respectively); UK Meteorological Glossary has also changed into the work of one person (Mclntosh) since the 4th edition in 1963. In USA on the contrary, the Glossary of Meteorology (1959) was collectively compiled by 41 editors. None of mentioned glossaries contained equivalents in other languages; this task has moved to separate bilingual dictionaries and to the International Meteorological Vocabulary published by World Meteorological Organization in 1966. The

collective model proved to be more efficient: while many European dictionaries by individuals remained out of date, some collectively issued glossaries moved to the Internet and have been further developed.

Contribution ID: 1101

E-POSTER Galileo Ferraris and the Scuola di Elettrotecnica of the Regio Museo Industriale in Torino

Emma Angelini, Margherita Bongiovanni, Annalisa Pesando
Appled Science and Technology, Politecnico di Torino, Torino, Italy

Galileo Ferraris (1847 – 1897), an Italian electrical engineer, is one of the pioneers of AC power system and inventor of the three-phase induction motor, considered together with the power transmission systems among the greatest inventions of all ages. He gained a master's degree in engineering and became an assistant of technical physics in the Regio Museo Industriale Italiano in Torino. In 1885 he researched the rotary magnetic field and successively experimented with different types of asynchronous electric motors. His work was really successful, resulting in the development of an alternator, an alternating-current motor operating in reverse, so as to convert mechanical power into electric power, as alternating current. In 1888, Ferraris established at the Regio Museo Industriale, a school of electrical engineering, la Scuola con Laboratorio di Elettrotecnica, the first school in Italy, subsequently incorporated in the Politecnico di Torino. Ferraris was a scientist, not an entrepreneur, he freely invited visitors to visit his laboratory, as testified by Willian Stanley an American AC pioneer, who had the possibility to see the polyphase motor first hand in 1885. Furthermore instead of patenting his work, Ferraris did the opposite, he published in 1888 his findings on his greatest invention: the induction motor. Inspired by the work of previous pioneers, as Walter Baily, Gaulard and Gibbs, Ganz Company and Ferranti, he became a leader and teacher of electric theory and design. He lead many organizations, as the Associazione Elettrotecnica Italiana in 1896, and was regarded as the foremost authority in electricity in Italy.
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Contribution ID: 1115

E-POSTER The unacknowledged accounts of the studies of the moon in the 1620s in the correspondence of Hevelius and von Löwen

Jarosław Włodarczyk
Institute for the History of Science, Polish Academy of Sciences, Warszawa, Poland

The optical libration of the Moon refers to the phenomenon when lunar spots change their position relative to the edges of the lunar disk. Its discovery was strictly tied to the development of telescopic observations of the Moon's surface in the first half of the 17th century, as well as to the emergence of selenography. The first published references to this phenomenon are said to be found in the works of Michael van Langren and Galileo Galilei, both originate in the 1630s. However, the first relatively complete description of lunar libration was offered by Johannes Hevelius in his *Selenographia* in 1647, a year before he started his correspondence with Elias von Löwen and his wife, Maria Cunitia. Cunitia is acknowledged for her *Urania Propitia* (1650), an innovative adaptation of Kepler's *Rudolphine Tables*. In

turn von Löwen authored astronomical calendars and ephemerids. Their correspondence with Hevelius has proved to be an interesting source allowing to update the chronology of the early studies of the libration of the Moon. In his letter of 24 June 1650 von Löwen states that first of all, he observed the libration of the Moon much earlier, and, secondly, that he already identified "its reasons" in 1623. To support his claim to be first to discover it, von Löwen attached to his letter his prognostications as regards the libration of the Moon in the second half of 1650. The paper offers a discussion of von Löwen's prognostications and their comparison with Hevelius's model in *Selenographia*.

Contribution ID: 1000

E-POSTER On the criteria of assessment of scientific achievements: the case of Vernadsky

Tatiana Denisova
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The assessment of scientists' contribution is extremely complicated; it is often decided by the tradition, political-ideological considerations, funding opportunities, prestige of the research area, etc. From this standpoint, we analyze certain of V.I. Vernadsky's contributions.
Vernadsky is considered not only a scientist, but also a philosopher, although he did not consider himself a philosopher, but a natural scientist. Thus, there is a discrepancy between the external and internal assessments of his sphere of activity. Is it necessary for historians of science to consider the opinion of the scientists?
In Russia, Vernadsky is considered an outstanding scientist, but in the West, he remains almost unknown. Therefore, there is a discrepancy between his national and international status. How this complies with the universal standards of science?
Vernadsky is a rare, for the 20th century, example of a scientist-encyclopedist, a phenomenon characteristic of an initial stage of development of science, the Renaissance. So, how his scientific profile can be assessed?
Certain scientific problems raised by Vernadsky, specifically the problem of the cause of time, were not advanced by him into a coherent and complete theory. Thus, how is it possible to assess his contribution?
Vernadsky's ideas about nature and the source of time originate from A. Bergson's relevant conception. But, unlike Vernadsky's guesses, Bergson's conception is well-founded and complete. Then, how can be assessed the scientific novelty and value of the achievements of a scientist who had an authoritative predecessor and teacher but left no successors or subsequent impact on science?

Session VII (Part 2/2) - Biographies

Contribution ID: 1035

Khaim Garber (1903-1937), on Technology: Another Eliminated Stream of Marxian Philosophy on Technology.

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The name of Khaim Iosifovich Garber (1901-1937), his biography and scientific works are little known to us. He was also so active in creation of Marxian view on technology and methodology for the history of technology in the Soviet Union in the first half of 1930s. There used to be, however, another stream in the Marxian history of technology in the Soviet Union in 1930s which was represented by Viktor Danilevskii (1898-1960) and, then, Anatolii Zvorykin (1901-1988), which had been long regarded as the main stream in the historical study of technology in the Soviet Union. Garber left only a few scientific works. By reexamining his view and methodology on the history of technology, clarifying their basic features and comparing it with the authorized Soviet-style Marxian view represented by Zvorykin, this paper sheds a new light to Garber's quest for the Marxian view and methodology for the history of technology.

Contribution ID: 1164

P C Ray and his role in Indian identity formation

ADITYA SUNDWA
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The second half of the 19th century witnessed the emergence of the Indian scientific community. This was the period when India was under the political control of the British Empire. Recent research has highlighted the various ways in which science and technology played an important role in the consolidation of British rule. We now know that the various Indian intellectuals who worked under the British were also interested in the newly emerging doctrines of science as a way of being able to develop their own identities independently of labels such as the "colonised" or even the "colonial". This process began during the phase of nationalist struggle in India and scientists-scholars often drew on discourses of political freedom in order to develop their own independent identity. A large part of this identity-formation lay in nuanced and indeed academic references to the Indian past. I argue P C Ray played a prominent role in consolidating the identity of Indian scientific community. This paper will also focus on the question of how their interpretation of the past helped scientists to form their identity.

Contribution ID: 1179

Dr George Shuttleworth's 'scholarly self' and the creation of the mentally deficient child in nineteenth and early twentieth century Britain

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On his death in 1928, Dr George Edward Shuttleworth was revered as a world leading expert in childhood 'mental deficiency'. This was a term medical practitioners used to describe a range of conditions including idiocy, imbecility, and feeblemindedness. Drawing on the work of Herman Paul, this paper traces the interwoven processes by which Shuttleworth contributed to the creation of the mentally deficient child as a category of scientific curiosity and social concern. Mental deficiency was part of a growing discourse of normalisation in childhood. It was an important idea in the developing science of psychology which reflected increasing interest in children's bodies and minds in late nineteenth and early twentieth century Britain. The paper explores how the articulation of forms of mental deficiency in

medical and socio-moral discourses was realised through the performativity of Shuttleworth's 'scholarly self'.
This expert 'persona' was multifaceted. It incorporated his activities as an observational scientist, a diagnostic clinician, an educationalist, and a social and legal commentator on the welfare of children. The paper examines the range of these interests through his contributions to the *Journal of Mental Science*, annual reports of the Royal Albert Institution - where he spent over twenty years as medical superintendent - and a range of other documentary and visual material. It shows how Shuttleworth's influential position within research oriented medical communities permitted him to validate and transmit his claims about mental deficiency as an authoritative man of science committed to improving the welfare of children.

Contribution ID: 1199
"If Bogdanov takes on a task he gets it done even though it seems impossible to everyone..."

Galina Krivosheina
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Anatolii Bogdanov (1834 – 1896), professor of zoology and the first director of the Zoological Museum at the Moscow University was one of the most industrious figures on Russian scientific scene in the second half of the 19th century. Though the list of what he has done for Russian zoology and anthropology, for popularization of science and scientific education is long enough, most Russian historians are still skeptic concerning his contribution to science. It's tempting to explain this by traditional for the Soviet ideology division of scientists into "bourgeois" that are to be neglected and "proletarian" that are to be praised. But actually we have to go further and inspect political culture of the tsarist Russia. During his lifetime Bogdanov was very popular, had a lot of followers and his name often appeared in the news, but the number of ardent opponents of his scientific and education projects was equally impressive. The main reason for that seems to lie in the fact that Bogdanov had a misfortune to provoke displeasure of his liberal university colleagues by conspicuous indifference towards social and political ills of the day. They also disapproved of his moral qualities, namely the methods he used to raise money for his projects (later Ivan Tsvetaev who tried to raise money for his Museum of Fine Arts would face the same attitude). The result of this was public criticism of Bogdanov though leveled not at his political or social stance, but rather at his educative and scholarly enterprises and scientific achievements. Although it seems a paradox that liberal intelligentsia opposed the essentially liberal educative projects, this situation was distinctive for the political culture of tsarist Russia with its strong state and weak civil society.

Symposium (Part 3/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 206

Contribution ID: 255
Giants and dwarfs at the Ordnance Office in the Tower of London

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The coat of arms of the Ordnance Office, displayed at the Tower of London from at least the last quarter of the 17th century, includes two Cyclopes. In Hesiod's *Theogony*, these giants forged Zeus's thunderbolt, hence the motto *sua tela tonanti*, 'to the thunderer his weapons' (often translated less literally as 'to the warrior his arms'). The Cyclopes' status as craftsmen is underlined by the tools they hold over their shoulders: a hammer and blacksmith's forceps. They remind us that the Tower at this period was an industrial site, with forges, workshops and a range of salaried artificers. Compared to the production of weaponry, military transport and supplies, the making, acquisition and use of scientific instruments at the Ordnance was, financially, small fry. However, although instrument making was usually outsourced, the Ordnance smiths were sometimes involved in making more specialist and precision items. We find, too, in the 17th century, instrument makers living and working within the Tower complex, even if not in regular employment by the Ordnance. John Milburn and others have explored the relationship of the 18th-century Ordnance with high-end makers – men like John Rowley and George Adams, whose instruments grace the collections at NMS and elsewhere – but this paper aims to highlight some of the comparative dwarfs of the story: lesser-known makers and artificers, revealed by scraps of evidence and often producing more quotidian objects that rarely survive in collections today.

Contribution ID: 320

Looking through and at giants: the iconography of telescopes and gigantism in the nineteenth century

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A race for ever-larger refracting telescopes is a well-established trope in the historiography of nineteenth-century astronomy, but the coeval iconography of such instruments deserves further analysis. These large optical devices embodied the (often unfulfilled) promise of pushing back the boundaries of astronomy, while showcasing the technical prowess of instrument makers and celebrating the might, wealth, enlightened outlook, and civic commitment of patrons. Primarily grounded on technical and scientific ambitions, the gigantism of such instruments was conveniently suited to perform these symbolic functions. However, gigantism was by no means exclusive to the realm of astronomical instrumentation. It has a well-established place, for example, in the history of architecture, and throughout the nineteenth century it was used with various aims across fields and contexts such as urban planning, world exhibits, and museum displays. This paper is a first attempt to situate the iconography of large telescopes, and particularly that of large nineteenth-century refractors, in a broader picture of gigantism, focusing on how instruments including the Harvard 15-inch telescope, the Chicago Dearborn refractor, and the Yerkes 40-inch were visually presented to both expert and non-expert audiences.

Contribution ID: 1320

Fermenting at scale: ICI's 'Pruteen' experiment – from animal feed to bioplastic, 1967-1991

Rupert Cole
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How did a failed £40m animal feed project initiate consumer revolutions in vegetarian food and biodegradable plastic?
In 1967 Imperial Chemical Industries (ICI), once Britain's largest manufacturer, embarked on an ambitious project to address one of the world's biggest agricultural issues at the time - the projected shortage of animal feed. 13 years and £40m later, ICI opened a giant fermentation plant at Billingham, North East England, capable of producing 50,000 tonnes of 'Pruteen' animal feed – the first industrial-scale protein made from bacteria and methanol. However, the expected market for animal feed had failed to materialise in the wake of the Green Revolution. ICI Billingham spent the 1980s adapting their fermentation technology and expertise to develop two new products: a mycoprotein foodstuff, which became Quorn; and Biopol, the first practical biodegradable plastic.
Was ICI's Pruteen experiment too big to fail? Taking a material culture approach, this paper examines the role of scaling-up in industrial research and development. It includes discussion of engineering and architectural models from which ICI Pruteen's plant was scaled-up, a series of R&D samples of mycoprotein and PHB plastic, and end products of Biopol, such as a biodegradable Wella shampoo bottle, released in Germany in 1990. Situating the ICI Pruteen story in shifting economic, social and environmental contexts, the paper argues scale, risk and surreptitious innovation are interwoven in industrial science. It also reflects on how environmentalist cultural trends have shaped and are shaping our interpretation of the material culture of industrial science and technology.

Contribution ID: 1030

Small components, "Big Science": electronics and engineering at the Mullard Space Science Laboratory

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The Mullard Space Science Laboratory, established in 1966 and descended from the UCL Rocket Group, is the oldest space science research institute in the UK. As such, it occupies a unique position in the history of space science. Moreover, unlike many other space science research institutions, it still builds and tests its own scientific instruments, drawing on the expertise of skilled mechanical and electronic engineers who are considered as integral to doing research as the academics within the Laboratory. It is thus a unique setting in which to investigate instruments for space science.
Electronics have been quite literally embedded in space science for more than half a century, and have become increasingly important as missions aim to collect greater amounts of data. However, the material culture of space electronics, as well as the significance of people working on ever smaller components to collect ever more data, is still poorly understood. In addition, the space electronics that researchers can study on Earth are flight spares and engineering models – analogues of the electronics built for scientific instruments in space, that are physically identical but which are placed into different environments, used for different purposes, and which consequently have radically different object biographies.

By combining the oral testimony of electronic engineers, instrument scientists and principal investigators with photographs and physical studies of flight spares and engineering models, we can gain a greater understanding of how engineers, instrument scientists and astrophysics researchers interact to produce massive quantities of data from these tiny components.

Session I (Part 2/2) - History of Astronomy

Contribution ID: 1026

The sphere of anthony ascham: the earliest known english translation of sacrobosco's sphaera by a minor renaissance author among elite commentators

James Brannon
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Sacrobosco's *De Sphaera* was among the first scientific works to appear in print. Distinguished Latin commentaries on this famous medieval cosmography soon followed, and included renowned author/publishers Erhardt Ratdolt, Jacques Lefèvre d'Etaples, Peter Apian, and Oronce Fine. Yet in 1527, amid these authorites, the unknown Englishman Anthony Ascham utilized Lefèvre's commentary to produce the earliest known English cosmography based on *De Sphaera.* His manuscript is historically significant since it came a generation prior to what scholars considered the earliest English *De Sphaera* by William Thomas in 1553. Large-sized and abundantly colored, *The Sphere* is a tour de force that prompts the historian to wonder who were the intended readers, and the work's purpose. Ascham simplified Lefèvre's cosmography by removing the commentary and advanced mathematics. But he enhanced it by adding many more diagrams and tables, a constellation atlas, a worldwide geography of maps, and stunning planetary vovelles. It was a remarkable visual commentary for its era. His readers were the multitude of literate English – those lacking a strong grasp of Latin and mathematics. By privleging the public over elites, *The Sphere's* purpose was to be an enticing introduction, a primer, to Lefèvre's edition and the Latin *De Sphaera* genre. The color-washed "*Sphere* for the people" stood in contrast to the monochrome Latin print editions for the select. Yet the single extant copy suggests Ascham never achieved his goal on a broad scale. After providing context, this paper discusses how Ascham employed Lefèvre, and other sources, to produce *The Sphere.*

Contribution ID: 1128

Astronomical tables in ancient Egyptian royal tombs from c. 1100 BCE

Sarah Symons
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Three royal tombs in the Valley of the Kings, Egypt, contain sets of 24 star charts. The charts were described by Champollion in 1833, and later analysed by Neugebauer and Parker in 1966 and Leitz in 1995, among others. Each individual chart contains textual and visual depictions of the state of the star sky during a 15-day period of the year. Within each chart, 13 stars mark time-points during the night encompassing twelve periods of observation. The position of each star is depicted on a seven-point scale. Text labels repeat the position and state the time and star name.
A complete set of 24 charts is referred to as a "Ramesside Star Clock" (each tomb belongs to a pharaoh called Ramesses). The "clock" implies a motive of timekeeping, but this is a modern conjecture as no

surviving sources mention such a practice. Surviving evidence of the use of the charts spans no more than 55 years. Their main interest in history of science is as a very early set of surviving observational records.
After a brief description of the tables, this talk will outline some of the challenges of reconstructing the observational methods that originally generated the data. Previous analyses of the tables have not fully accounted for the distribution of star altitudes that the tables appear to incorporate, and the nature of the seven positions remains a key question. Here, a method for analysing star movements in the tables using statistical methods and planetarium software is proposed.

Contribution ID: 1109

Is Oppenheimer the father of black holes?

Carla R. Almeida
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In 1916, the first solution to Einstein's equation of general relativity described a black hole, but this conclusion was reached only decades later. The history of the theoretical discovery of black holes has a slow beginning, characterized by wide denial of the phenomenon of gravitational collapse. It was counter-intuitive; it did not have observational evidence to support it, and it defied the philosophy of the time. In this context, two "giants" had prominent roles concerning the evolution of the theory. Arthur Eddington placed himself as opposition to the idea of collapse, advocating for the hypothesis of stellar equilibrium. While J. Robert Oppenheimer published the first paper with a thorough prediction of gravitationally collapsed objects. I will reassess the historical status of those giants in this history. In particular, I will question the title of father of black holes given to Oppenheimer, giving a deeper perspective to his contribution.

Contribution ID: 1160

Exploring Pluto and Europa: the U.S. planetary sciences and politics, 1989-2020

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This paper examines three decades of NASA planetary mission planning through the lens of flights to Pluto and Europa. In a tortured process that took fourteen years, the agency finally approved a Pluto mission in 2003. (New Horizons flew by the dwarf planet in 2015.) It won in part by defeating a technologically more difficult flight to the Jovian moon Europa. However, since the latter target remained a high scientific priority in the first two planetary science decadal surveys, 2002 and 2011, because it harbors possibly habitable global ocean, a mission was repeatedly revived under several different guises. For a time, it was a part of a joint Jupiter-system project with the European Space Agency (ESA). Finally, in 2014/15, a new concept, Europa Clipper, succeeded in both reducing cost and winning Congressional support.
Together, these two case studies reveal the evolution of planetary science policy in the United States after the Cold War. The introduction of competitive mission selections resulted in new institutions competing with NASA's primary planetary center, the Jet Propulsion Laboratory, which in turn increased political intervention into NASA's budget. That helped foster the adoption of the decadal survey system

to produce a scientific consensus on what missions were important, independent of partisan politics. For both Pluto and Europa missions, the decadals were crucial in securing funding. A mission to Europa was also impelled by a rebranded astrobiology that imagined new, more exotic potential habitats for extraterrestrial life.

Contribution ID: 1142
A Hitheto Unknown Iranian Calendar Named Yamīnī

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Zīj-i Yamīnī, the second oldest Persian work in the *zīj* tradition, was composed by Mūḥammad ibn Abū Naṣr Ḥaqāyiqī in Ghazna(present Afghanistan) in 6th century AH(12th century AD). Who dedicated it to Yamīn al-dowlah, Bahram one of the Iranian Ghaznavid rulers. He introduced in it Yamīnī calendar, a lunar Hejira calendar, established on the beginning of Bahram's rule. This calendar never became popular. He describes the epoch of the Yamīnī calendar as the Saturday, first of Muḥarram of the year 511 AH(1120 AD). It coincides on the 5th of Ayār of the Bicorned year 1428 and the 20th of the month Khurdād of the year 486 of the Yazdigird era. It uses the same months as the Arabic calendar.
Besides the Yamīnī calendar, Ḥaqāyiqī mentions Persian, Arabic, Syrian, Indian and Jewish calendar and how to convert each of these calendars into Yamīnī calendar in Book I of his *zīj.*
In this paper, I will discuss the Yamīnī calendar in detail and its application in *Zīj-i Yamīnī.*

Symposium (Part 1/2) Politics, Protest and Big Technology (ICOHTEC) - ID 564

Contribution ID: 706
Transnational Localism? Knowledge Production in the Italian 1970s-80s Anti-Nuclear Movement

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The focus on nuclear power in contemporary historiography has long been limited to states that currently own nuclear weapons or produce electricity from nuclear sources. On the contrary, Italy, following a referendum that obliged the state to renounce nuclear energy in 1987, has suffered from selective academic oblivion. While works have been produced both on Italian nuclear diplomacy (Curli, 2001; Nuti, 2007) and on biographies of illustrious Italian nuclear physicists (Bruzzaniti, 2007; Turchetti, 2012), the anti-nuclear movement, which developed from the mid-1970s to the late 1980s, has been neglected (with a few exceptions: Poggio, 1996; Bini and Londero, 2017; Candela, 2017). Whenever it has been analysed, it has been characterised as exclusively local. In this paper I employ methods from oral history and archival research to understand whether this was really the case, by focusing on the role played by the initiators of the Italian anti-nuclear movement. These people were mainly physicists, often politically engaged within left-wing parties or groups. As internationalist academics, they often had

strong connections with their academic colleagues of similar political views in Europe and the USA. My aim is to assess the extent to which information exchanged at the transnational level through these scientists may have contributed to the development of anti-nuclear narratives within the movement, providing it with a powerful scientific basis on which to buttress their claims. I conduct my analysis by resorting to different concepts of expertise developed in the STS since the 1990s (Wynne, 1996; Jasanoff and Kim, 2009, 2015).

Contribution ID: 891

Postcolonial nuclear consensus and contemporary anxieties: a history since the global re-enchantment with nuclear India

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The aspirations and apprehensions surrounding nuclear technology in India have attracted attention of historians of technology to study India's nuclear program through several lenses: postcolonialism, cultural theories, feminism, knowledge and power, and national security. However, 2005 marked a new chapter for these histories as the nuclear deal with the US ended India's international isolation, allowing nuclear imports after 35 years.
This opening reshaped older anxieties and engendered newer ones – a section of the country's secretive and privileged nuclear establishment resented, leading to a *de facto* restructuring of its leadership with closer proximities to the political elite and greater public engagement. It also led to anxieties at the levels of parliament, media and other democratic actors as Left parties dramatically withdrew from the ruling coalition, institutional re-arrangements like the new nuclear liability law and nuclear regulator to cater to these altered realities, and massive popular protests at the grassroots which intensified in the wake of the 2011 Fukushima nuclear accident.
This paper will analyse the recent history of nuclear technology in contrast with the earlier history when India's nuclear establishment was internationally more isolated and domestically insulated. It will study the tensions between the inherited bureaucratic impulses of the nuclear establishment and the pressures to open itself up – both due to the entry of international/private players and increasingly more public questioning in an era when the old consensus has weakened and new media and the adoption of transparency measures such as, the Right to Information Act have allowed more scrutiny.

Contribution ID: 649

The public lantern's interplay of light and darkness: between police monitoring, savings-based extinguishings, and protests (Paris, Barcelona, 18th c.)

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The gap between the early modern policing ideal of a homogeneous—"geometric"—perception of the urban territory thanks to street lighting, and the persistent reality of dark areas, was particularly clear during periods of turmoil in the public order. In both Paris and Barcelona, the revolutionary episodes of the eighteenth century severely tested the new streetlamps, known as reflector lanterns ("*lanternes à*

réverbères"). This article will explore, by adhering as closely as possible to the object, the limitations of technical innovation in public lighting.
During the Enlightenment, lighting was one of the favored instruments within the policing ideal of an even perception of urban space. This ideal of lighting nevertheless had to contend with its limits. We will compare Paris and Barcelona, where illumination was a major instrument of police control. Although these two cities had a chronological gap (public lighting appeared in 1757 in Barcelona, nearly one century after Paris), their streetlighting institution were connected due to French influence on the technical administration of Bourbon Spain. We will identify what was shared by as well as unique to each context. This comparison will especially include moments of disorder, with the major episode of the *avalot de las quintes* Catalan revolt in 1773, and the French Revolution in 1789. We will more specifically explain why and how hopes of uniformly lighting the territory failed, allowing for light and dark areas to exist side by side, despite the innovative development of the *réverbère* lantern.

Symposium (Part 2/6) Transportation History: Colonial and extra-European railways (ICOHTEC) - ID 489

Contribution ID: 966
Transport and public works in the Moroccan protectorate. The Tangiers-Fez railway (1914-1927) and civil engineer J. Eugenio Ribera

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In the wake of the 1906 conference at Algeciras and the 1912 treaty between France and Spain that created the two protectorates, consolidating territories and borders in Morocco, a number of public works, including roads, railways and ports, were initiated in pursuit or economic development, industrial progress and social welfare, i.e., pacific dominion. Civil engineers envisaged Spain as a possible strategic crossroads in world politics, a nexus between Europe and Africa. Direct railways had to be designed, the passage across the Strait of Gibraltar resolved and railroads built in Africa. Tangiers-Fez was one of the railways designed and built in those years. The developer, the 'Compañía Franco-Española del Ferrocarril de Tánger a Fez', was expressly created in 1914. The railway itself was designed by José Eugenio Ribera and built by his company, 'Compañía de Construcciones Hidráulicas y Civiles, S.A.'.
Eugenio Ribera's role was singular not only in his involvement in these projects, but also in connection with one of the most prominent factors in public works construction in Morocco: the development of reinforced concrete technology, a concern closely related to J. Eugenio Ribera's endeavours. The paper will describe the features that characterised a specific period in the history of civil engineering.

Contribution ID: 832
How the Panama Isthmus Railroad Accelerated American Commercial Expansionism

Shunsuke Munakata

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The presentation will aim to illustrate how U.S. congressmen tried to utilize railroads as a vital tool to expand the country's commercial and diplomatic activities overseas. The applicant analyzes evidence from debates, inside and outside Congress between 1848 and 1855, on plans to build the Panama Isthmus Railroad, revealing the intention of politicians to achieve American expansion into Asia.
With Thomas Jefferson's promotion of the Louis and Clark Expedition in 1803, and with the subsequent promulgation of "The Monroe Doctrine" in 1823, some influential Americans started to harbor ambitions to secure the geopolitical dominance of the United States over the Western hemisphere, and to establish an economic foothold in Asia. The Panama Isthmus was a location vital to achieving these goals.
The United States and Nueva Granada (which ruled Panama at that time) signed the Mallarino-Bidlack Treaty in 1846, permitting the U.S. to move American citizens and cargo through the Panama Isthmus. The New York-based Pacific Mail Steamship Company, accredited to operate maritime transportation between Panama and the American west coast, petitioned the federal government to subsidize the construction of a railroad across the Isthmus, arguing that it would not only speed the carriage of people and cargo but also boost American trade activity with Asian countries. Together with congressional advocacy, the company's generally enthusiastic attitude was crucial in ensuring the railroad was opened in 1855.

Symposium (Part 2/2) Collaborations and Rivalries in the History of Mathematics (ICHM) (with IMU) - ID 87

Contribution ID: 109

Circumventing gendered barriers to knowledge through spousal cooperation: Mrs and Mr Mary Somerville

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As a nineteenth-century British woman, Mary Somerville's engagement with learned academies and polite scientific society was neither consistent nor straightforward. Whilst she was 89 before being elected a full member of any institution (Societa Geografica Italiana, 1870), Somerville benefited from the resources and social networks cultivated in such spaces from as early as 1812.
Dr William Somerville, her husband, was a key mediator between herself, her scientific contemporaries, and the institutions of which he was a member; indeed, William provided Somerville with vital access to both actors and knowledge. Using the extensive correspondence held in the Somerville Collection, at the Bodleian Library in Oxford, we will investigate how Somerville's husband took on the roles of chaperone, secretary, and later literary agent. Moreover, we will consider how Somerville actively used him to liberate knowledge from behind the closed doors of learned societies, and to pursue a successful career publishing mathematical and scientific books.

Contribution ID: 221

George Boole & Mary Everest Boole

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English mathematician George Boole (1815–1864) is widely acknowledged as a principal inventor of mathematical logic; his wife, Mary Everest Boole (1832–1916), also published prolifically on related topics, though her reputation has been more contentious. According to Mary, who established herself as a mathematical pedagogue after George's death, his engagement with symbols was a deeper, more spiritual practice than the staid academic tone of his published work betrayed. She intertwined her mathematical discussions with religious issues and other, frequently mystifying detours. In her work she often claimed to be revealing, with privileged insight, the real significance of her late husband's work. George never committed himself in writing to any metaphysical claims of the sort Mary favored; in light of his reticence to speak publicly about his own beliefs, along with the temporal distance between his publications and hers, it is difficult to discern which of her ideas he shared. Though some readers have condescendingly taken Mary's more obscure pronouncements as license to dismiss her writings entirely, a scholarly consensus has now emerged that she was a generally reliable, if sometimes opaque, witness, and a capable author in her own right. In this paper I aim to understand their interaction and the interaction of their respective works. By considering the Booles' history as a case of asynchronous collaboration, I will explore what it meant for Mary to attempt to work with an absent collaborator, to shape his posthumous legacy, and to present it as a product of both their writings.

Contribution ID: 118

Who counted Professor Weldon's crabs: Florence Weldon and the hidden labour of 19th century data analysis

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or centuries a "computer" was a human who computed, initially entirely by hand, with mechanical calculators, and devices for collating data stored on punched cards, more common from around 1900. Records are sparse, but there are many examples where the data analysis and detailed calculation underpinning scientific papers were done by women, often family members of the male author, uncredited, and unpaid.

Florence Joy Weldon, nee Tebb (1858–1936) studied mathematics at Girton College, Cambridge, and worked closely with her husband, Raphael Weldon, Oxford's Linacre Chair of Zoology, applying techniques developed by the statisticians Francis Galton and Karl Pearson to biological data. For example, in 1892, 23 measurements were taken from each of 1000 adult female shore crabs from the Bay of Naples, and analysed, by hand, to show that 22 of the 23 features were normally distributed, and one was bimodal.

In his lifetime, Weldon's numerous papers relying on such detailed data analysis did not once mention his wife: manuscripts completed by Pearson after Weldon's death acknowledge "F. J. W.". We place Florence Weldon in the scientific context and conventions of the day, in exploring broader question son women's hidden labour.

Contribution ID: 249

Richard von Mises and Hilda Geiringer: a partnership in applied mathematics emerging from a teacher-student relationship and welded by persecution

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In the 1920s Richard von Mises led a school of modern applied mathematics at Berlin University. His influence and their in some respect one-sided human and scientific relationship was beneficial to Hilda Geiringer's development as a mathematician and as a teacher. Geiringer was near to topics pursued and taught by von Mises (statistics and theory of plasticity), and she supported his career and his posthumous reputation substantially. Her research found recognition in the international community of mathematicians as well. Geiringer's emotional and idolizing relationship with one Mises let her forget about or at least let her tolerate the specific conditions adverse to women's emancipation. The latter included some traditional male-chauvinist positions and prejudices on the part of von Mises, but also the conditions of emigration (Turkey, U.S.) which were particularly disadvantageous for female scientists. In spite of some subliminal but outwardly covered conflicts between the two, the overall outcome of the collaboration of the mathematicians' couple was positive for both of them, both on the individually and subjectively, and with respect to the development of applied mathematics as a whole.

Symposium Crossing the borders between meteorology, climatology and geography (Commission on the History of Metereology and Commission on the History of Geography) - ID 424

Contribution ID: 583

The Maldivian Nakaiy calendar in the age of climate change

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The island communities of the low laying coral island nation of the Maldives have always depended on in-depth knowledge of the sea and the land for their sustenance and livelihood security. The *nakaiy* (constellation in *Divehi*) calendar, used by Maldivians for centuries, is derived from the positioning of the star constellations and the predictable weather patterns to determine the fishing and agricultural practices. At the base of the system are the two distinct seasons determined by the monsoons (*Hulhan'gu* and *Iruvai*). The calendar passed down through the oral tradition and songs, is divided into 27 *nakaiy* with 18 falling in the southwest monsoon (*Hulhan'gu*) and 9 in the northeast monsoon (*Iruvai*). A *nakaiy* is a period of approximately 13 or 14 days, and the system predicts how minor climatic changes observed in the annual cycle of the ocean's rain, wind, current and tide patterns affect the main seasonal activities. Before the current change in lifestyles, everyday life and everyday activities of Maldivians revolved around the *nakaiy* calendar. For example, travelling, fishing, land clearing, digging of wells, planting and harvesting of crops, building keels for new boats were among the

many activities regulated according to the calendar. *Nakaiy* was also used to foretell people's fortunes as well as determining auspicious (or inauspicious) times to do things. In the age of climate change, many people have the impression that the duration and condition of *nakaiy* are changing. Traditional knowledge as a critical resource can help understand and promote resilience to climate change.

Contribution ID: 581

For an epistemology of climate science(s) in Latin American: between convergences, breaks and perspectives

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In the scope of sciences epistemology, the decolonization of knowledge has emerged in recent years, with the main objective of the relationship between local and "universal" knowledge. It is from this dialectic of the global and local, that an epistemology of climate sciences for Latin America is defended; that historical, social, economic and cultural contexts bring new perspectives to understand climate phenomena, with specific methodologies and theories. In Latin America, the development of climatology precedes meteorology, being a singular process of institutionalization of climate sciences that in a relationship of colonial knowledge imported models and paradigms adapted to the local reality, which, however, is insufficient to offer explanations for the problems, demanding epistemological ruptures: between meteorology and geography or between hegemonic and counter-hegemonic knowledge. In view of all the above, the objective of this paper is to reconstruct the institutionalization of climate sciences in Latin America since the 19th century, taking Brazil as the main case study, and from there to explain the ruptures and new perspectives of the approach in developing.

Symposium (Part 1/3) Knowledge of the heavens in transcultural perspectives : the circulation of astronomy and astrology between civilizations - ID 142

Contribution ID: 178

The modes of adaptation of babylonian astronomical knowledge in early imperial China

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Scholars have located possible traces of Babylonian astronomical knowledge in sources from early imperial China. This research aims to explore the similarities between the Chinese and the Mesopotamian evidences. Although it is difficult to find a clear route of transmission of astronomical knowledge between two cultures, but it is still significant to look through the existing evidence and compare the ways of adapting similar knowledge in different systems. For example, the use of the equal twelve-fold division of the heavens in Chinese astronomy, paralleling the 'zodiac signs' in the west will be

discussed. A selection of sources will be explored to reveal Chinese and Mesopotamian conceptions of astronomical knowledge and terminologies, with the aim of contributing to a better understanding of the diverse roles of knowledge in the development of Chinese and Mesopotamian astral sciences.

Contribution ID: 301

Rāhucāra of the Gārgīyajyotiṣa – The oldest Indian eclipse theory extant and its transmission in Central and East Asia

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Since the establishment of the *Gargasaṃhitā*Workgroup in 2017, the decipherment of one of the oldest Indian astral treatises has been ongoing (Geslani, Mak, Yano, and Zysk. *History of Science in South Asia*5.1 (2017): 151-191). Among the sixty-four chapters of this work, the one on the eclipse entity, Chapter Four: Rāhucāra or "The Course of Rāhu," contains certainly some of the oldest descriptions concerning the ancient Indians' understanding of the eclipse as an astronomical phenomenon. Garga's eclipse theory subsequently formed the basis of the corresponding section in Varāhamihira's *Bṛhatsaṃhitā*, an encyclopedic work on natural sciences that has taken an authoritative status in learned Indian society since the sixth century CE. Beside its influence on the South Asian subcontinent, the work of Garga is also known in Chinese sources, and was certainly transmitted via Central Asia and was subsequently translated into Chinese before theseventh century CE. This paper will examine this hitherto unedited chapter in the work of Garga and explore its reception in East Asia.

Contribution ID: 169

The planetary positions and zodiacal signs of Horoscope Astrology during the Tang and Song Dynasties

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Abstract : This paper will discuss the connotation of the twelve signs of the zodiac in ancient Chinese texts. This connotation was different from that of the system of the zodiacal signs in used in Greece and India, since it was based on the Chinese system of twelve Jupiter-stations. The significance of the Chinese system was interpreted differently by the various astrological schools. The position of the moon in astrological writings such as P.4071 and ИНВ.No.5722 was related to the timing system of lunar mansions, but this feature was not found in other texts such as *Xiuyao Yuyunlu* and *Xiuyao Yunmingkanlu*. Therefore, it was speculated that the role of the moon's position in the theory of horoscope astrology during the Tang and Song dynasties had changed from the actual astronomical phenomena to the timing system of lunar mansions resulting from the influence of Buddhism. In conclusion, the method of determining planet positions in horoscope astrology during the Tang and Song dynasties was derived from a fusion of three cultures, namely, the names of zodiacal signs in Greece, the 28 lunar mansions divination in India and the connotation of the twelve Chinese Jupiter-stations. The fusion of these cultures reflected the integration and transformation of foreign horoscope astrology in ancient China.

Contribution ID: 203

The competition between the 12 Zodiacal Signs and the 28 Lodges in Genethliacal Astrology China, 6th to 16th centuries CE

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Genethliacal astronomy, which divines the fate of the individual based on the astrological circumstances of his or her birth, appeared to have been introduced into China from India during the third century. At that time is was structured in terms of the Indian system of 27 or 28 lunar mansions. Later, the 12 Zodiacal Signs have reached China in the 6th century CE. From various received and excavated Genethliacal astrological materials in China from then to the 16th century, we can find that methods of fate calculations in astrology changed from being based on the locations measured by the degrees of the 12 Zodiacal Signs to using the system of the 28 lodges. The transformation was gradual and complex, and during this transformation the two measurement systems coexisted in personal fate calculations. During with the process of transmission, the astronomical methods used for fate calculations changed the ways they calculated the positions of celestial bodies. Also, the rules to predict auspicious or inauspicious fortune changed.

Symposium Decolonising Pandemics? (Pacific Circle) - ID 512

Contribution ID: 615

'Modernity as pandemic: settler Australia as an experiment in self-quarantine'

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The Australian Commonwealth can be defined as the 'negative commonwealth', a polity defined by a series of radical exclusions. Class strife, racial and religious divisions, ethnic and linguistic diversity, indigeneity, and even history itself were all to be banished. The widespread notion of Australia as a 'social laboratory', a metaphor initially proposed in 1910 but then routinely used to identify a cluster of coordinated experiments in social policy, was linked on an appreciation of isolation. Isolation was a scientific fantasy (a scientific laboratory must be isolated; no replication without isolation), and a category derived analogically and discursively to advances in epidemiological knowledge and tropical medicine. The founding fathers enthusiastically embraced a cluster of related metaphors and used them to define 'Australia', a polity conceived as a sociopolitical laboratory on a continental scale, an experiment in quarantined self-isolation from what was routinely represented as a terrible world. In a way, modernity itself was perceived as a pandemic. The 'tyranny of distance' was thus reconfigured as a blessing in disguise.

Contribution ID: 894

small pox, science and settler colonialism: contested historiographies

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Small pox arrived in Australia with settlement, and was a major cause of Indigenous population decline in the first two decades. An assessment of the causes, extend and effect of small pox, this paper argues, is part of an ongoing political contestation in settler-dispossessory Australia this presentation will explore. Major arguments in this contested history are for example in how far the introduction of small pox has been understood as a deliberate action or an unfortunate event; a shared fate of Indigenous people and settlers; an illness that rush ahead and therefore can be de-linked from dispossession through settlement.

Contribution ID: 970

epidemic and De-imperialisation through the case of Japanese Imperial Army Soldiers in PNG during WWII

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Decolonisation is usually considered as a process of undoing colonization between the coloniser and the colonised. But this structural hierarchy can also be applied internally among imperial nationals, in terms of psychological decolonisation or deimperialisaton. The colonised in this case are Japanese Imperial Army Soldiers.
Global war mobilities of goods and people created a national hierarchy among the imperial subjects. Japanese Imperial Army Soldiers who were sent to and left in the hellish battlefield, PNG with scarce military supplies were placed at the bottom of the imperial hierarchy. PNG was commonly deemed as a place of hellish battlefields in mainland Japan. Lack of food, medical supply sapped the soldiers' health, made them susceptible to an epidemic, left them unattended and led to the death of many. Approximately 50% of the deaths of soldiers were caused by diseases or starvation, not by battle. In this space, these soldiers no longer lulled by promises made by the imperial government. When they managed to survive through epidemic and starvation and became POWs in lands remote from the imperial centre, their minds were de-imperialised and they began to question imperial ideologies. And they even discussed a "new Japan" in the Allied interrogation reports. This presentation analyses these Japanese POWs as migrant survivors of epidemic and starvation, and investigates their discussion of a "new Japan". And it will argue that epidemic and diseases provided an opportunity for them to relativise their views about imperial ideology and de-imperialise those views.

Contribution ID: 1292

Malaria, mobility, and the death of the fair races: German scientific models of hardiness as (inevitable) decolonization.

Christine Winter
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This presentation explores medical and cultural models of malaria, developed by Dr Otto Dempwolff, a colonial medical doctor and 'father' of Austronesian comparative linguistics. Observing a population group of then German New Guinea that he argued was of Melanesian race but mixed Austronesian/non-Austronesian language, Dempwolff developed a hypothesis of hardiness, migration, and population decline. Underlying his Malaria and migration theories are theories of 'white'or 'fair' bodies' responses to Malaria. This presentation explore Dempwolff's underlying assumptions about racialised bodies and reads his pre-Koch hypothesis in light of their de-colonising logic.

Symposium 60: Designing curricula as an interdisciplinary programmed framework in the history of science & scientific–technical teaching

Contribution ID: 170

Can environmental philosophy enhance the understanding of the physical world?

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In this presentation we argue for the inclusion of the study of basic concepts and theories of Environmental Philosophy in the Physical Science Curricula.
While the contribution of History and Philosophy of Science in science teaching has been adequately documented thus enhancing our understanding of the nature of science, it still remains very controversial whether students can acquire an understanding of the very idea of "nature" which is the object of the knowledge process involving science. We thus propose a shift from the "nature of Science" (noS) to the "nature of Nature" (noN).
The study of Environmental Philosophy in the Physical Science Curricula should examine our relation, as human beings, to nature or our natural environment: it should review our philosophical understandings of nature and our conception of nature's value; it should explore how we are to live with and in nature and to what degree nature is or is not implicated in our own human identity.
Environmental philosophy includes in its scope all the core discourses of philosophy: metaphysics, our assumptions about the basic substance and structure of things; epistemology, how we come to know and understand nature and how different epistemologies reveal different aspects of the natural world; aesthetics, the patterning that may or may not be taken to confer meaning or value on nature; and ethics, the morality of our treatment of living things and systems.
Preliminary findings of the implementation of this proposal to non-science majors will be reported.

Contribution ID: 243

A NoS Experimental Curriculum on motion: Galileo and His Contemporaries

Vincenzo Cioci
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Based on my doctoral research at the Lille University (supervised by Prof. Raffaele Pisano), I analyze historical sources concerning the *experientia* performed by Galileo about his studies on motion (*Discorsi*

su due nuove scienze in *Le Opere di Galileo Galilei*, Vol. VIII, Terza giornata and Quarta giornata; *Ms. Gal.* 72). The aim is to develop a NoS educational curriculum, modelling and replicating the historical foundations of these experiments. The historical and experimental context of the time has been reconstructed, leaving the students an active role in carrying out the experiments. The ideas of the scientists who preceded Galileo were very useful in teaching because they anticipated–represents the difficulties encountered by the students and to effectively plan an experimental historical educational path. I already had interesting results during latest 3 years involving ca. two hundred students of the Liceo scientifico "F. Sbordone" in Naples where I work as qualified teacher in Physics. In my talk, I present this fascinating story and NoS results are discussed.

References

Galilei G. (1602-1637) *Ms. Gal. 72*. Works of Galileo, P. 5, T. 2. Central National Library, Florence
Galilei G. (1890-1909) *Le Opere di Galileo Galilei.* Favaro A. (ed). Firenze, Barbera
Pisano R., Capecchi D. (2015) *Tartaglia's Science of Weights and Mechanics in the Sixteenth Century*. Dordrecht, Springer
Pisano R., Cioci V. (2020) *Galileo's Free fall into History Physics & Nature of Science Teaching.* In: Mantovani R. et al. (eds) *Proceedings SISFA 38th*. Pavia, Pavia University Press, *forthcoming*

Contribution ID: 208

Emergence and Contingency in Modern Scientific Theories. New Insights in Teaching.

Anastasios Kapodistrias
National And Kapodistrian University of Athens | IDTC, Athens, Greece

Since the second half of the twentieth century, there has been a rising interest about the notion of emergence and its explanatory power in describing the development of modern scientific theories. Recent works in the philosophy of science showcase an ongoing discussion on the various divergent definitions used to describe emergence, its contradictions with reductionism and its connection to concepts such as non-predictability, complexity and contingency.

In this presentation, we are going to discuss the connection between emergence and contingency focusing on the development of three modern scientific theories: i) in Chaos Theory, we are going to discuss the emergence of physical properties as a result of non infinite precision in calculating a system's initial conditions ii) in Evolutionary Biology, we concentrate on the theory of Punctuated Equilibrium and Stephen J. Gould's approach for the occurrence of species extinctions, and iii) in the history of Quantum Mechanics, we discuss James Cushing's insight for the role of historical contingency in theory selection in science.

Finally, since physical theories as appearing in secondary science curricula, reflect a mechanistic and reductionist approach, we are going to demonstrate how the study of simple nonlinear systems and its interdisciplinary applications by giving emphasis on emergence and contingency can be of great pedagogical significance with respect to the "nature of science" giving new insights in secondary education science teaching.

Symposium (Part 1/2) To explore from West to East: persons, methods and results - ID 81

Contribution ID: 101

From Saint-Petersburg to Beijing. The line of magneto-meteorological investigations. Second half of 19 – early 20 centuries.

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Investigating and recording the weather, climatic changes and the changes in the earth's magnetic field were among the goals of scientists in the 19 century. In 1715 on the territory of Beijing the Russian Orthodox mission was organized. The Russian Orthodox Mission played an important role in the development of the Russian-Chinese relations. On the territory in 1848 the Magneto-meteorological observatory was built. It was included into the Russian Empire's Observatory's network. In 1866 the Magneto-Meteorological Observatory and other Magneto-Meteorological Observatories on the territory of the Russian Empire and outside (Mongolia and China) were transferred under the jurisdiction of the Russian Academy of sciences. It provided concentration of all the magnetic and meteorological investigations in one center – the Academy of Science. Therefore, it gave rise to the weather forecasting development on the vast Eurasian territory.
During the 19th century, Russian meteorological science slowly expanded its reach from Saint Petersburg all the way to Beijing by creating an "anchor" observatory, then adding other observatories in Mongolia, Eurasia, and Formosa. The last director of the observatory H. Fritsche made a lot of expeditions on Siberia and China to establish new stations. That institutional network, along with a standardized method developed for scientific research, enabled scientists to test theories about weather and climate. That chain of observatories was the most important one linking Europe and Asia and was probably the largest geographical scientific network in the world at that time.

Contribution ID: 335

History of technology

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This paper mainly discusses the development of Japan 's survey and mapping technology in the Edo period. By tracing the work by Tadataka Ino(1745-1818) , a famous survey specialist of that time. In Japan, many research works on Ino's surveying diaries, his life and measuring techniques have come out since the 1870s by university researchers, novelists and folks. But the paper notes that there have never been studies on the influences from China or any comparative studies be-tween Japanese and Chinese measuring techniques. No works on Ino or his survey have been found in China. Therefore, the paper, for the first time, accounts for his astronomic and calendric background .and the reasons why he carried out his survey. The paper also studies the impact of the Chinese translations of western scientific works introduced into Japan and the western astronomy and calenders introduced into Japan during the period of Dutch studies "on Ino. It describes as well the measuring tools he used and his astronomic observing

activities. Finally, the paper lays stress on the significance of Ino's map for modern Japanese measurement science history.

Contribution ID: 133
E-POSTER N.A. Nordenskiöld's polar expeditions and the Russian society

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Understanding of the necessity to study the Northeast Passage in the Russian government circles was preceded by a long period of individual enthusiasts' activities. One of them - N.A. Nordenskiöld made the first navigation from the Atlantic to the Pacific oceans in 1878-1879 and proved that the Northeast Passage existed. Nordenskiöld was born in Finland, which was part of the Russian Empire at that period. Despite his emigration to Sweden, the most important part of his activities was the Russian polar seas studies. His expeditions had the great importance for science and became prerequisites for the further polar region research programs. Based on a wide range of historical sources the article examines Nordensheld's contacts with Russian businessmen, scientific organizations and scientists. Nordenskiöld linked the shipping along the Northern Sea Route to the development of trade in Siberia. Nordenskiöld's studies coincided with the Russian industrialists M.K. Sidorov's and A.M. Sibiryakov's interests so they provided organizational and financial support to the scientist. The Nordenskiöld's polar expeditions results were scientifically examined by the Russian leading scientific institutions - St. Petersburg Academy of Sciences and the Russian Geographical Society, where they were highly evaluated. Creating classical scientific works about the Russian North scientists used Nordenskiöld's data. S.O. Makarov and D.I. Mendeleev were inspired by Nordenskiöld's scientific success and proposed a project to study the Arctic region with a new type of ships - icebreakers

Contribution ID: 198
E-POSTER Imperial exploring expeditions: a case study on the archeographic expedition

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In the first half of the nineteenth century, the Russian Empire carried out the "Archeographic Expedition" (1829-1834). After that, the new imperial academic institution "Archeographic Commission" was established, which greatly contributed to the development of Russian historiography. A large number of expeditions since the eighteenth century were adapted to use in the natural science research and the benefit of the European empires as well. The focus of this paper is, why the investigation for the purpose of ancient literature appeared during the long-term scientific explorations by Russian Empire.
Expedition as a method of exploring knowledge has a long tradition in the West. In that process expedition has gradually become an important approach. Until the rise of the Western Empires, in order to overcome the challenges of the environment around the world, scholarship and imperialism found cooperation space. The Russian Empire was a later rising "Western Empire", without experiencing the

Renaissance. In addition, its geographical conditions were different from those of Western countries, that the routes and the purpose of expeditions were different from others. Their characteristic was that Russia was based on the interior of the country, while the destinations of the Western expeditions were outside the countries. The Archeographic Expedition is an example, that the travel routes were limited to the European Russia. The Russia Empire has never had such a great expedition for special purpose of ancient literature. This paper will examine the background of this expedition.

Symposium (Part 1/3) Reflections of science and technology in the Ottoman Empire: scientific interactions among various ethnic and religious backgrounds, societies and institutions - ID 436

Contribution ID: 803

Issues and Problems of Addressing Multi-dimensional Scientific Activities in the Ottoman Empire

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The intercultural and scholarly interactions among the integral parts of the vast mosaic of the Ottoman population that were stretching over three continents, namely South East Europe, Asia Minor, Caucasus, Levant, North Africa, part of the Gulf countries, Hejaz and Yemen, are still left undiscovered areas waiting for interdisciplinary and multidisciplinary research. This diverse mosaic of the population consisted
of various communities of different ethnic and religious backgrounds, e.g. Turks, Arabs, Greeks, Armenians, Jews, Albanians, Hungarians, Serbs, Croatians, and Bosnians. Today thanks to the publication
of the 18 volumes of the History of Ottoman Scientific Literature and the 2 volumes of Ottoman Scientific Heritage, we are better equipped to discover, study, and explain aspects of these intercultural and scholarly interactions. There are two big categories to be observed in these uncharted waters, the first interaction is among three Islamic languages, (Turkish, Arabic, and Persian), the second includes translations from other languages to Turkish and Arabic. In this second category, we observe two subgroups, the first, translations from classic Greek and Latin to Arabic and Turkish; the second from modern European languages to Turkish and Arabic.
Meanwhile the ethnic background of scholars belonging to different religious communities e.g. Muslim, Orthodox Greek, Orthodox Armenian, Jews provide insights to the different processes of interaction of scholars, production and exchange of knowledge, the movement of ideas during a 6-century long history of the Ottoman Empire. This is certainly a virgin field of research waiting for cooperation of scholars with diverse background.

Contribution ID: 607

E-POSTER The Principle and Drawing of a Universal Asterlobe

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The Principle and Drawing of a Universal Asterlobe

In a traditional astrolabe, the earth and the sky spheres are projected onto a plane parallel to the earth equator by means of a stereographic projection according to a pole supposed to be located in geographical south pole. The biggest advantage in the astronomical calculations come from a very important property of this projection. All the straight lines and circles in the celestial sphere are projected as straight lines or circles on the plane of projection and the angles between them are preserved. When it is desired to observe celestial bodies and determine the time in a classical astrolabe, one needs a special plate providing the projections of the south azimuth and horizon elevation circles related to the latitude of the observation point. On the contrary, a universal astrolabe does not need a special plate, since the stereographic projection pole is centred at the spring equinox and the plane of projection is a great circle perpendicular to the horizon passing through the geographical poles of the earth. The purpose of this paper is to clarify the principles and drawing rules of a universal astrolabe.

Contribution ID: 574

E-POSTER "Reflections of science and technology in the Ottoman Empire: scientific interactions among various ethnic and religious backgrounds, societies and institutions (PART 1/3)

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It is not exactly known when the first logbooks were introduced to the Ottoman ships. However, Ottoman archival sources show that the first examples of logbooks (*seyir defteri* or *seyir jurnali*) seem to have appeared towards the end of 18th century. In the reign of Selim III (1789-1807), Grand Admiral Küçük Hüseyin Pasha introduced a new obligation for the Ottoman ships in 1796. Ship captains had to keep two notebooks on the ships; one covering regulations (kavaid-i bahriye) that galleons were subject to, other, a kind of logbook for recording the events to be encountered during the journey. The books containing naval regulations would be composed of a leather cover in red colour and a binding of yellow chain. On the other hand, logbooks would be of marbling cover. 30 copies of these two books (15 for each) were prepared and delivered to the ships. Beside these books all the captains had to keep Pirî Reis' *Kitâb-ı Bahriye* as a guidebook and they were responsible for completing and commenting on this precious book according to their own observations. Moreover, the crew of a warship had to carry navigational equipment in order to find their route, geographical locations and sail ships into the intended country in safety. Among this equipment were compasses, sounding leads for measuring the depth of the sea and hourglass. This paper is aimed at tracing down the process of introduction of the logbooks to the Ottoman ships, underlining its importance for the science of navigation.

Contribution ID: 580

Professionalization in Science: Tanzimat to Turkish Republic (1839-1946)

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Nineteenth-century is "the longest century of the Ottoman Empire" that witnessed important changes and improvements in many aspects. One of these changes can be traced through missions of people having scientific knowledge or carrying out scientific activities. There were many dynamics behind the practice of science as a profession in the Ottoman Empire. To examine these dynamics will contribute to the understanding of popularisation and professionalization of science in the Ottoman world.
The history of science examines social networks and professional organizations that contribute to science in addition to other fields of research. The scientist, the most important component of the organization, is the person who performs science as a profession. This profession makes people gain status, money, reputation, and respectability. This paper aims to examine the shift in scientist's identity and his/her involvement in scientific activity/occupation in a new form beginning from the Tanzimat reforms to the emergence of modern Turkish Republic. In this context, process of professionalization in science will be taken up with reference to some leading scholars, institutions, communities, ideas and discourses.

Contribution ID: 965
Ahmet Muhtar Pasha's astrolobe making manuel: Riyaz al-Mukhtar

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Ahmet Muhtar Pasha's Riyaz al-Mukhtar Mirat al-Mikad wa al-Adwar is a voluminous book depicting scientific instrument making. The book was written during Ahmet Muhtar Pasha'smilitary missions as one of the high-ranking commanders in Ottoman army. It describes the astrolabe, sundial (basita) and astrolabe quadrant (rub al-mukantarât) making processes in detail. The writer also adds drawings to his work to make the process more comprehendible and compares the calendars that Ottomans used throughout centuries. Present paper aims to take a deeper glance at Ahmet Muhtar Pasha's above-mentioned book and highlight its importance in comparison with other scientific instrument making books.

Symposium (Part 2/3) Science and literature in small and large scales (Commission on Science and Literature) - ID 271

Contribution ID: 686
What postage stamps can tell us about the scientific instruments?

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The postage stamps, these small works of art that were and are being collected by children and adults, live in an uncertain world because the exchange of emails threatens their own existence.

However, for the time being, the postage stamps continue to extravagantly carry pictures and messages which travel with letters from one country to another, at the same time being brief visual messages that each state transmits to its citizens and to other states. From this point of view, the choice (or not) of a theme on postage stamps is of particular value as it reflects the perspective that each state has (or is trying to diffuse) on this issue.
The present paper deals with the representation of scientific instruments in postage stamps, attempting to answer questions such as:

- Do postage stamps depict the scientific instruments to highlight them or they use them to convey a message, and if so, what is it? What messages is trying (or can) produce a postage stamp depicting a scientific instrument?
- How are the scientific instruments depicted on the stamps? Are they alone or next to scientists and what is the message in each case?
- Are scientific instruments primarily depicted around a central axis of science and technology, thus being part of a world cultural heritage or more as the scientific highlights and evidence of a particular state?
- Is there a correlation between the states that choose to have scientific instruments on their postage stamps to their economic or technological level?

Contribution ID: 978

Hands-on knowledge: medieval manuscripts, instruments, and literary interpretation

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We examine the links between medieval manuscript culture, interpretive practice, and instrument culture with special consideration of Chaucer's Treatise of the Astrolabe. We discuss ideas of making and crafting knowledge common to compilation culture as they extend to text and instrument production, as well as scientific and literary knowledge. The concepts and principles of compilation in manuscript culture required a material understanding of text that recognized the object status of the codex. This links literary texts in an essential and natural way to instruments such as the astrolabe. Like mathematical instruments, the compiled text had an object status in itself, but was also an interpretive mechanism of reading other objects: it was a geometer, a measurer of the world, an object of objects. In the codex compilation culture of the late middle ages, knowledge-making was both a personal, embodied experience and a philosophical, cosmological enterprise. Like the knowledge composed in compiled literary manuscripts, instrument-based knowledge also synthesized individual and cultural knowledge- making. Based on the examples drawn from the manuscripts and instruments linked to the Treatise of the Astrolabe, we characterize an "epistemology of compilation culture" that locates knowledge in the body as well as the mind. In this way, instrument culture and literary culture inflect on each other, theorizing knowledge as active, material, and "hands-on," even in the act of textual interpretation.

Contribution ID: 1082

On the Spanish origins of the "Cientifico/a"

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It is commonly reiterated in English historiography that the word "scientist" was invented in 1834 by William Whewell as an analogy with "artist". Due to the actual preponderance of the Anglo-Saxon academy, this notion has been extrapolated to other European languages. This is clearly palpable in the case of Spanish historiography who has repeatedly and uncritically repeated the moto.

Nevertheless, the history of the world equivalent in Spanish, "científico/a", is not as straight forward related to the history of its English counterpart. Clearly, the word "cientista", which would be a direct and more exact translation of the world "scientist" does not exist in our language.

It is also important to note that "cientifico/a" in Spanish may also been use as an adjective or an adverb to describe different instruments, actions, or persons. In fact, in this sense we can find it been use as early in the XVI century, to describe knowledgeable people such as the kings or "reyes científicos". It acquired its more modern meaning at the end of the XVIII century, when it was first used to describe people who not only knew, but acted.

Contribution ID: 1253

Writing a biography of a so-called 'dwarf' in science: the example of the female geneticist Tine Tammes

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Learning more about a dwarf in science, the biographical method is 'the basic axis of research', as stated on the conference website. However, in such a case, applying the biographical method will often not be easy, because archival information is central in that method and such information is then usually scarce. This scarcity will often be experienced when studying a woman in science. I will discuss some challenges and possible solutions when writing a biography about a female scientist that left fewer traces behind than one would wish for a biography. I will focus on Tine Tammes (1876-1947), first Dutch professor of genetics and first female professor at the University in Groningen. There is no archive of her, and there are only a few letters written by her in archives of others. I will demonstrate when drawing wider circles around her, the way she succeeded to be a female scientist can rather satisfactorily be discussed. I will embed her life and career at the one side in the then sizable international group of female geneticists and at the other side in the group of women at her university. It will then become comprehensible that she could have a successful life and career, which would not have been possible when only using direct archival evidence.

Symposium (Part 1/4) Placing mathematical knowledge in a world of and beyond nations (IASCUD) - ID 452

Contribution ID: 931

The topology of interwar Japan: studying an emerging community institutionally and conceputally

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Focusing on internationalization bears the danger of blurring local and even not-so-local deviations. A case study that widens our perspective and enriches our understanding of the circulation of knowledge during the early 20th century can be found in Japan. Integrated into international networks but facing a certain physical and cultural distance, the Japanese came to do science on their own terms instead of following a specific foreign model. Mathematicians at the universities in particular could enjoy considerable academic freedom while profiting from the material expansion of the Japanese Empire.
In this setting, looking through the lens of topology – as an object of research – brings to light remarkable continuities and discontinuities: Just as in several other fields, Japanese mathematicians gained international recognition for results obtained during World War One. But in contrast to – for example – number theory and abstract algebra, it took until the 1930s that a research tradition in topology was institutionalized in Japan. We can name key actors and key events in this, but this alone does not do justice to the phenomenon itself or the Japanese mathematical community as a whole.
Adopting Karen Barad's theory of agential realism proves key to overcoming the limitations of accounts which only encompass interactions of institutions, individuals and instruments: When studying what can be referred to as the mathematical community of Interwar Japan, one should not so much linger on causality. One should rather frame it as emergence, exploring connectivity and boundaries – and thus embrace topology as a device for historiography.

Contribution ID: 681

From circulation to transfer of knowledge: infinitesimal calculus in Colombia during the 19th century

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By acceding to independence at the beginning of the 19th century, Colombia gives the historian of mathematics the case of a state, mainly held during centuries outside the scientific world, that suddenly opens up to international influences at a moment when mathematics and their diffusion are making great steps forward. The introduction in the new republic of an essential notion such as the infinitesimal calculus brings up multiple questions about the circulations around the Atlantic world, and the part taken by different actors involved. To answer this, we will follow the journey of a mathematics teacher from the south of France to Bogota, then study in details the scientific teachings established in Colombia, and we will even be concerned by the circulation of theorems considered later as erroneous. These steps will eventually bring us to the delicate question of the appropriation of notions linked to infinitesimal calculus by Colombian engineers and scientists.

Contribution ID: 613

Computing with WEIZAC in the early days of the State of Israel: Chaim Pekeris's contribution to applied mathematics (1948-1960)

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Chaim Leib Pekeris (1908-1993) was the driving force behind the project of building and operating an electronic computer in the early 1950s at the Weizmann Institute of Science (WIS), in Rehovot, Israel. The WEIZAC, as the computer was called, was built in the years 1954-55 and worked in full capacity for almost a decade. The computer was modeled after the famous machine of the Institute for Advanced Study in Princeton, which operated since 1952. Mathematicians and scientists from WIS and from other research institutions in Israel, as well as members of other Israeli government organizations, used the computer to advance science in Israel and to spread the word of this new technology all over the country. My talk will discuss the specific scientific contributions of Pekeris that were based on calculations performed with WEIZAC. Years before the WEIZAC was built, Pekeris had already planned the calculations he could make with it, and once it was operational, he was indeed the chief consumer of computation time. The ethos of applied mathematics that he introduced into WIS was diametrically opposed to the ethos of pure mathematics that had been promoted at the Hebrew University in Jerusalem, ever since Edmund Landau in 1925 inaugurated this well-defined, distinguished research tradition. The inherent tension between these two conceptions was a main moving force behind the raise of Israel as a world-class powerhouse of mathematical research.

Symposium One hundred years of Niels Bohr's Institute (Commission on the History of Physics) - ID 365

Contribution ID: 461

Koç's theory: an unorthodox interpretation of quantum mechanics

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The orthodox Copenhagen interpretation of quantum mechanics was questioned in terms of principles of locality and completeness by Albert Einstein, Boris Podolsky and Nathan Rosen (EPR) in 1935. If position or momentum of either one of the entangled particle pairs is measured, the information can not travel to the other faster than the speed of light. According to EPR, the wave function representing the state of particle pair should have hidden variables for the quantum mechanical description of reality to be complete. A theoretical response was published in the same year by Neils Bohr under the same title of EPR paper. While Louis de Broglie, David Bohm, Basil Hiley and others were trying to establish a quantum theory based on hidden variables until 1980s, they could not convince the scientific community because of their complicated mathematics and the idea of a quantum force. John Stewart Bell published a paper on EPR paradox in 1964 and showed that no hidden variable theory could explain quantum mechanical results. Around 1980s, Yalçın Koç, a philosopher physicist from Boğaziçi University in Turkey, demonstrated that quantum mechanical expectation value functions have bilinearity property. He also showed that spin is bilinear. Koç's theory is as follows:

As long as a local hidden variable theory is bilinear and it satisfies rotation invariance, Bell inequalities could not exclude local hidden variables.
In this presentation, Koç's theory will be introduced within a historical context and the reason why it has been ignored will be discussed.

Contribution ID: 556

The history of the niels bohr institute as seen through the life and career of christian møller

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The Danish theoretical physicist Christian Møller (1904-1980) worked at the Niels Bohr Institute (NBI) throughout his active career, from his student days in the late 1920s to his retirement as professor of mathematical physics in 1975. His important scientific contributions spanned over a wide field, from quantum field theory, nuclear physics and S-matrix theory to problems of general relativity. Møller was also a central figure in the administration of the NBI and its relations to other organizations such as CERN, the Solvay Institute and the Committee for Gravitation and Relativity. From 1957 to 1971 he acted as director for NORDITA (Nordic Institute for Theoretical Nuclear Physics). Not least, as a teacher of physics courses at NBI for more than three decades, he left his stamp on a generation of younger physicists. A study of Møller's career, in part based on archival sources, offers a window to the history of the NBI in periods when its former glory faded and when it was faced with problems of a scientific, political and organizational nature. In this difficult process of re-legitimizing its existence, Møller played an important role.

Contribution ID: 1102

The Socrates of physics: looking at Bohr through Wheeler's and Heisenberg's eyes

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What did Bohr do? That is a question which, as F.Wilczek once stated echoing a comment in Pais's biography of Bohr, could make a good number of his colleagues mumbling vaguely and generically, thirty years ago as well as today. How come did Bohr achieve such a pre-eminent status among 20th-century physicists, which does not seem to reflect his (still remarkable, of course) list of 'concrete' contributions? Was he overrated in his days thanks to his charisma? Or perhaps due to his solemn and enigmatic sentences, uttered from his authoritative pulpit?
Something similar could be asked in the case of J.A. Wheeler too, Bohr's "apostle" (J.Gleick) in Princeton: he was, and still is, regarded as a towering figure in physics, although people just seem to know that he adopted the phrase "black hole" and coined the slogan "it from bit" (besides mentoring many distinguished physicists). We could ask again: what did Wheeler actually do? Or better: on what basis are we, at large, willing to confer him such a high position in history?
In this paper, I intend to propose an answer – a partial one, surely – to these questions, in the light of Wheeler's own reflections about Bohr and his role within the physics community, and the lessons he learnt from him in doing science. Remarkably, his considerations greatly resonate with those of another

exceptional witness, W.Heisenberg, and prompt us to put in question some widespread format of writing scientific biographies and naively conceiving scientific greatness.

Session VIII (Part 1/2) - Gender

Contribution ID: 1248

Moving beyond disciplinary limits and gender role in Spain: C. Arenal (1820-1893) on psychology

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Some historians have already shown how at the end of the 19th century and beginning of the 20th, jurists and law experts became interested in psychological science. At the same time, also psychologists made attempts to lecture psychology to law students and to enter into the courtroom as new experts. To understand such a historical development it is important to point to the rise of criminology in the 1870s, which took place under the leadership of the Italian anthropologists. Lombroso and his followers pursued a scientific study of human differences, linking criminality to psychological and anthropometric diagnostic methods. It represented a turning point in the history of forensic medicine and juridical psychology. Spain followed the Italian's lead and psychology would soon also there become one of the topics of interest for forensic psychiatrists, criminologists and jurists. In my talk I will deal with Concepción Arenal Ponte (1820-1893), who is well known for her work as inspector of women's prisons, as well as her role in the feminist movement. In my talk I will focus on a rather unknown part of her work, putting Arenal's article on comparative psychology within the broader historical (and intellectual) context. Her article, published 1886, contains an attack not only against the work of the Italian anthropological school, but she also criticizes the organization of Spanish society at large.

Contribution ID: 1148

Degeneration, Gender, and German Immigration: the case of Elza (Rio de Janeiro, 1920s)

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According to Wadi (2017), Elza's case published by Muñoz and Facchinetti (2011) is one of a reduced group of studies about anonymous individuals in the Brazilian history of psychiatry, supported by the history from below (Burke, 1992). The small number of sources about the patients' daily life at the asylum explains why this historiography remains so reduced. However, Elza's case has several historical sources: clinical records, newspaper and medical articles, judicial processes, family documents, and immigration records. Elza was a German woman who migrated to Rio de Janeiro in 1921 and four years later was hospitalized by the police in the National Asylum for the Insane. Elza wanted to return to Germany to get a divorce because it was prohibited in Brazil. Her husband requested the hospitalization to avoid the divorce and Elza's return to Germany. At the asylum she was diagnosed with an "atypical state of degeneration", leaving the institution after eight days through a *habeas corpus*. In a letter

published by a local newspaper, Elza could successfully denounce her husband's actions. Until now, our analysis was concentrated on Elza's diagnosis. Some aspects remain unexplored. Supported by transnational history (Budde, Conrad and Janz, 2010) and Giovanni Levi's theory on microhistory and immigration (Levi, 2015), we aim to investigate the gender relations and German immigration through Elza's case. We associated Elza's *habeas corpus* and request for divorce with her social status, her German nationality, and her sociability in Rio de Janeiro at the time, typical of *Deutschtum*.

Contribution ID: 1168

Cotton, makeup and a prosthetic penis. Male and female trans* embodiment techonologies in the mid-twentieth century in Argentina

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This presentation is part of a wider project that studies the making of *sex change* in Argentina during the twentieth century. This text studies the male and female *sex change* repertoires in the mid-twenttieth century. By focusing on the social trajectory of four people borned between 1917 and 1924, shows the daily technologies and knowledge with which they embodied their new gender. This generation in particular, materialized their gender between the early experience built over clothing and the emergence of medical surgeries that became a public matter in Argentina during the 1960s.
This transformation is interpreted by two main reasons. Firstly, because the social context was changing, since the 1930s province governments multiplied legal codes to restrict sexual dissidence expression in public spaces. Being names and imprisoned, could have created experiences for self-recognition. Secondly, because the popularization of new technologies and the rise of massive consumption transformed the way in which trans* embodied themselves. In this context, we show how medical and popular discourses about *sex* changed by the introduction of concepts as *trasvestiment* and in later *transexualismo*, converged with a more flexible notion of sex that considered multiple factors beyond genitalia, an introduced the idea of dominant and dominated male and female caractheristics in everyhuman being.

Symposium (3/7) 16th Annual Symposium of the Social History of Military Technology (ICOHTEC) - ID 126

Contribution ID: 849

Ottoman ıntelligence and weaponry

SOMER ALP ŞİMŞEKER
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During the First World War the Ottoman army was re-established and there was a huge transformation in both staff and weaponary. Allied with the Germans, Ottoman army's inventory of weaponry had

significant changes. The Second Branch of the General Staff (responsible for millitary intelligence) had set out a large scale investigation about the allied Powers' weaponary and their efficiency. This investigation was put to reports and send both to civillian bureaucracy and also to the army. Lacking of insufficient funding, Ottoman Empire had to mobilize the public for budget to source the necessary budget to get new weapons by using propaganda. The small reports given by the Second Branch became bigger concern for both the army and the society. The reports consisted of the technological innovations, and precautions to be taken about them. Our presentation will focus on the reports given to the the military intelligence section (Second Branch) of the General Staff about the Allied Powers weaponary, efficiency and suggestions.

Contribution ID: 541

The jeune école and the development of China's naval defense, 1870s-1890s

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In mid-1870s, French admiral Hyacinthe-Laurent-Théophile Aube published 2 papers which outlined the fundamental ideas of the *jeune école*, and the theories was tried out in 1880s since Admiral Aube became the French Minister of Marine. The new naval theory emphasized the importance of several specific types of warships, such as cruisers, coastal defense gunboats and torpedo boats. These ideas had directly or indirectly influenced China's strategy of naval defense. The Fuzhou Navy Yard, which was established in 1866, transformed from building wooden ships to building iron ships in 1880s. During this time, WEI Han and other Chinese naval engineers, who had graduated from Fuzhou Navy Yard School and then studied and investigated in France for several years, played a crucial role in introducing French warships to China.
Based on *Archives of Coastal Defense* (海防档) and *Memorials on Fuzhou Navy Yard*(船政奏议汇编), this paper analyzes the shipbuilding program of Fuzhou Navy Yard during 1870s-1890s and finds the resemblances with contemporary French warships. Furtherly, the author also discusses the dilemmas that these engineers struggled with: their possession of professional knowledge versus their low status in the bureaucratic system; and the necessity of establishing a modern navy versus the short of financial support. Actually, these dilemmas reflected the obstacles that an agricultural country faced when beginning to develop a modern industry, which also partly interprets the failure of China's Self-Strengthening movement.

Contribution ID: 141

Beyond the usual Verdächtige - Military innovation in Central Europe from the Vereinsgewehr to the Feldl machine gun

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The 19th century is one of rapid technological progress and constant military innovation and reform. These developments are usually seen through the eyes of the major powers such as England, France, or later in the century Prussia/Germany. However, military innovation was not confined to major powers or large armies. Medium-sized armies, while quite possibly even harder hit by the effects of technological

progress than major powers given their limited resources, not only tried to simply follow the lead of major powers but were in fact actively looking for innovative technological solutions to the ever-changing battlefield.
The paper will therefore discuss how some of Europe's smaller powers adapted to technological progress in the decades following the middle of the 19th c. and whether the technological and administrative solutions found had any influence on developments in major armies. The paper will focus on three case studies from German-speaking central European armies, taking a closer look at technology that, while soon made obsolescent by technological progress and political developments, at the time was comparable if not superior to the technology fielded by major powers: the Vereinsgewehr, a rifled musket introduced in 1857 into the armies of Württemberg, Baden and Hesse and an early case of cooperative arms acquisition, the Podewils-Gewehr, a rifled musket introduced in 1858 to the Bavarian army and possibly the finest rifled musket of its time, and the Feldl gun, one of the first machine gun to see active service with a central European army in 1870.

Contribution ID: 961
Technology and french colonial warfare 1871-1914

William Dean
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After the Franco-Prussian War (1870-71), France dramatically expanded its colonial empire in West Africa, Madagascar, and Indo-china. Technology played an important role in this expansion but not so much through weapons technology but through logistical and medical innovation.The multiple campaigns that were fought in Africa and Asia did serve as a test-ground for new weapons technology from magazine-fed rifles to aircraft. More than a generation ago, Daniel Headrick in his famous Tools of Empire argued that modern rifles and machine-guns were essential to the vicotry of colonial powers in Africa and Asia. I contend that it was logistical innovations like tinned meat in West Africa that played a key role in the conquest of this region not the latest weapons technology. In fact, French machine-guns were highly unreliable and heavy artillery was impracticable. .In medicine, the French were failry effective in West Africa and Indo-china but because of the absence of training and standard operating procedures, the use of prophylactic drugs failed in Madagascar. Here nearly 5,000 men died of disease and the rear area was described as a vast cemetery. It was only in Morocoo 1907-1914 that new weapons technology was highly effective and prepared the French Army for the Great War.

Symposium (Part 1/2) DISHAS and recent research on the history of astronomical tables: Latin, Sanskrit and Chinese sources (CHAMA) - ID 76

Contribution ID: 108
Editing and analysing John of Lignères' Tabule magne with DISHAS

Matthieu Husson

CNRS-SYRTE-Observatoire de Paris-PSL, Paris, France

The *Tabule magne* consists of a set of canons and tables compiled by John of Lignères (Paris, fl. 1320-1340). Together with a *saphea* and an *equatorium* texts, they were dedicated to Robert Bardis, dean of Glasgow, in 1325. In the Latin context, the *Tabule magne* are the first to rely on double arguments layouts for planetary equations tables. They are also important in the transmission of the Alfonsine astronomy in England. The canons are now attested in at least seven manuscripts and different portions of the tables set are known to be in twenty manuscripts. I will present salient features of this work and its manuscripts tradition relying on a natively digital critical edition and analysis realised and published with DISHAS.

Contribution ID: 145

What does the seven metre long 18th century Sanskrit astrological scroll contribute to our understanding of astronomical ideas from western India ?

Aditya Jha, Sahana Cidambi, Clemency Montelle
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We analyse the historical, cultural and mathematical features of a rare 18th century Sanskrit astrological Scroll, about 7 meters long, which was donated to the University of Canterbury by the daughter of Albert Williams Andrews, a Brigadier General in the British Indian Army, from New Zealand. The scroll consists of several computational tables and beautifully depicted visual charts on planetary motion, which were used to make predictions for a native, unidentified clearly, to whom the scroll originally belonged. Prima facie investigations reveal that the native was a resident of the Gujarati peninsula Kathiawar's Sorath prant (present day Surat) of India and had a close affiliation with the influential Nagar Brahmins, a caste found primarily in Gujarat. Recomputing the true planetary longitudes and mean motions given in the scroll tables will allow us to comment on the text or the school of astronomy from which these tables possibly originate and thus build our understanding of the transmission of astronomical ideas in Western India.

Contribution ID: 146

Tables, calculations and calendars in a time of crisis: the production and public consumption of astronomy in China, 1664-1669.

Christopher Cullen
Needham Research Institute, Cambridge, United Kingdom

In the period from 1664-1669, proponents of three different astronomical systems, each with its own tables and methods of calculation, were involved in a bitter struggle for control of the Astronomical Bureau *Qin tian jian* 欽天監 of the early Qing 清 dynasty (1644-1911). Each system came from a different cultural tradition: one was the product of a long period of development in imperial China, while another was a 15th century sinicisation of an Islamic system ultimately based on the work of Ptolemy of Alexandria. The third was a version of 17th century European astronomy imported by Jesuit missionaries Failure in this conflict certainly involved loss of official posts and salaries, but might also lead to a death sentence. This talk will look at the ways in which the calendars issued by the *Qin tian*

jian during this period reflect this struggle, and show the influence of the different tables and calculation procedures on which they were based.

Session II (Part 2/3) - Biological Sciences

Contribution ID: 1001

The dwarf that created a giant industry: The culture of dwarf mulberry tree and its spreading in China

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The silk industry occupied an important place in the History of economics. In order to make their own kingdoms rich, many sovereigns tried to introduce this industry into their own territories. Even though they succeeded in creating weaving centers, it was difficult for them to produce enough raw silk for supplying their weaving industry.
The term "sericulture" refers to silkworm (i.e. Bombyx mori) rearing for the production of raw silk. The topic interested scholars who studied development of techniques in various countries and the circulation of technical expertise. Nevertheless, it can be argued that the culture of mulberry trees, which supply the essential food of Bombyx, was not studied sufficiently well. During the Song period (960-1279) in China the Jiangnan region overtook the Delta of Yellow river and became the center of sericulture, this happened mainly due to the success of the culture of dwarf mulberry (*disang* 地桑). The Chinese term of dwarf mulberry for the first time appears in the *Qimin yaoshu* 齊民要術 (The essential techniques for common people) by Jia Sixie 賈思勰 (active 534-550). However, at that time, its culture did not seem to develop well enough.
This paper aims to deal with the culture of dwarf mulberry tree and how its cultivation favored the development of sericulture. Through a systematical analysis of books on agriculture, treatises on sericulture and local gazetteers, completed by field survey, the author describes the history of dwarf mulberry cultivation and the circulation of the respective techniques.

Contribution ID: 1032

The founders of Romanian biological oceanography - Emil Racovitza, Ioan Borcea and Grigore Antipa

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The founders of Romanian biological oceanography - Emil Racovitza, Ioan Borcea and Grigore Antipa

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Over a century passed since the Romanian participation in the major oceanographic research cruise, on board *Belgica*, in the Antarctic waters (1897). The following development of marine sciences in Romania is due mainly to **Emil Racovitza** (1878-1947), **Ioan Borcea** (1879-1936), **Grigore Antipa** (1867-

1944) and others, and to their institutional establishments such as the Marine Zoological Station at Agigea - Constantza (1926), the Bio-oceanographic Institute in Constanţa (1932), the National Museum of Natural History in Bucharest (1934) a.o. Other professors, researchers and museographers contributed to the progress of biological oceanography. Witness stands also Romania's affiliation to many regional and international scientific organizations like the **International Commission for the Scientific Exploration of the Mediterranean Sea**, UNESCO, the **International Ocean Institute** etc. Romanian leading marine research and development institutes, namely the ***National Institute for Marine Research and Development „Grigore Antipa"*** in Constantza and the ***National Institute for Marine Geology and Geoecology***, respectively, as well as new created marine environment devoted NGOs. They interacted with the activities of the **Black Sea Commission**, acting on the mandate of all six Black Sea coastal states which on April 21,1992 signed and shortly thereafter ratified the ***Convention on the Protection of the Black Sea Against Pollution***, the Commission on the Protection of the Black Sea Against Pollution (***Black Sea Commission***) of the ***Convention and the Black Sea Strategic Action Plan***.

Contribution ID: 1182

D'Arcy Thompson, civic science, and fin-de-siècle Darwinism. A case study of scientific and social change

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Charles Darwin, it is well known, regarded Hermann Müller's book on the fertilization of flowers by insects as a major achievement of the international sub-specialty he had launched twenty years earlier with his monograph on the fertilization of orchids.
D'Arcy Thompson was a student under Francis M. Balfour and Michael Foster at the University of Cambridge when he conceived the idea of translating Müller's monumental book. He edited it as a sign of his ambition to join Darwin's sub-specialty and embark on an academic career. Published in 1883, the translation was prefaced by Darwin himself. It was one of his last writings, outlining the "general biological problems" he expected that a new generation of followers would address.
Thompson was to defy the expectation. In 1884 he left Cambridge to join a group of professors called to launch a new University College in industrial Dundee. There he met the kind of civic science that several of his young colleagues thought necessary to address the dramatic social conditions of Victorian Dundee. Combined with Thompson's earlier education in anatomy, classical humanities and religion, his views of a civic mission for science distanced him increasingly from the agendas prevailing among fin-de-siècle Darwinists. Speaking to the BAAS in Oxford in 1894, he declared his belief that "growth may be more exuberant in the absence of struggle and hardship". He was already on the road leading to *On Growth and Form*, the highly original, idiosyncratic book that he published in the middle of World War I.

Symposium (Part 2/3) Knowledge of the heavens in transcultural perspectives : the circulation of astronomy and astrology between civilizations - ID 143

Contribution ID: 167

Who Are the of Indian Astrology Text in the Chinese Tripiṭaka?

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All genuine Buddhist sūtras are regarded as being records of words uttered by the Buddha himself. Thus all the names attached to Indian astrology texts in the Chinese Tripiṭaka, are those of of translators. Among the translators, some are very well known in the history of Buddhist literature, such as Kumārajīva, Xuanzang, and Yijing; some of them are otherwise unknown to researchers, such as the translators of the *Modengjia jing*. Meanwhile, some Buddhist sūtras in Chinese are not translations at all, such as the famous *Xiuyao jing*, which was in factcomposed by a Chinese astronomer. There is no doubt that the main source of Buddhist astrology texs was Hindu astrology. But the study of Hindu astrology was limited to a few families in the Indian tradition, and it is not clear how the transmission into Buddhism was possible. It is not easy to find answers of the above questions, but it is hoped that exploration and discussion in this talk may lead to new insights.

Contribution ID: 154

On contemporary epochs in Chinese calendrical systems and their possible foreign origin

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The epochs in ancient Chinese calendrical systems received a great deal of attention for political and philosophical reasons. Astronomers tried to find the epoch time when the revolutions of the Sun, the Moon, the five planets, the lunar perigee (or apogee), the lunar ascending node, and the stem cycle, etc., all started at the same single point. As a result, the number of years between the epoch and the year when a calendar system was created was often huge, reaching tens of thousands or even tens of millions. In this presentation, I will point out that in some Chinese calendrical systems, however, an epoch only a few tens or hundreds, of years before the date of creation of the system was adopted. And further evidence will be given indicating that the adoption of such 'contemporary epochs' in Chinese calendrical systems was a result of foreign influence, which probably originated from Indian astronomy.

Contribution ID: 157

Ibn al-Zarqālluh's discovery of the annual equation of the moon

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Ibn al-Zarqālluh (al-Andalus, 1100) introduced a new inequality in the longitudinal motion of the Moon into Ptolemy's lunar model with the amplitude of 24', which periodically changes in terms of a sine function with the distance in longitude between the mean Moon and the solar apogee as the variable. It

can be shown that the discovery had its roots in his examination of the discrepancies between the times of the lunar eclipses he obtained from the data of his eclipse observations over a 37-year period in the latter part of the eleventh century and the predictions made on the basis of the lunar theories in the *Mumtaḥan zīj* (Baghdad, 830) and al-Battānī's *zīj* (Raqqa, 929), which were available to him at the time. What Ibn al-Zarqālluh found is a special case of the annual equation of the Moon, which is applicable in the lunar eclipses. The inequality was discovered by Tycho Brahe (1601) and Johannes Kepler (1630). As Ibn Yūnus (1009) reports in his *Ḥākimī zīj*, Ibn al-Zarqālluh's medieval Middle Eastern predecessors, Māhānī (880), Nayrīzī (922) and ʿAlī b. Amājūr (920), were already acquainted with the problem of the eclipse timing errors, but it had remained unresolved until Ibn Yūnus provided a provisional, and incorrect, solution by reducing the size of the lunar epicycle. As we argue, the diverse ways to tackle the same problem stem from two different methodologies in astronomical reasoning in the traditions developed separately in the Eastern and Western regions of the medieval Islamic domain.

Contribution ID: 397

Al-Bīrūnī's interpretation and revision on Indian mathematical astronomy in "India"

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Abstract: In order to introduce Indian culture and science, al-Bīrūnī finished his work *Kitāb fī taḥqīq mā lil-Hind min maqūla maqbūla fī al-ʿaql aw mardhūla* (*A Book on the Study on India according to the Literature, a Reasonable Acceptance or Rejection* or *India*) in A.D.1030. As a distinguished mathematician and astronomer, al-Bīrūnī interpreted the main subject divisions of Indian mathematical astronomy, including the Indian division of time, ahargaṇa (the time elapsed since the astronomical epoch) and planetary theory. Besides his interpretation, Al-Bīrūnī also make some revisions which he thought were reasonable and necessary. However, the clarity of his interpretation and the rationality of his revision still need to be further checked and understood in the context of intercultural communication among Greek, Islamic and Indian cultures.

Symposium (Part 1/2) Under Tropical Skies: Relocating Giants and Dwarfs in Meteorology (International Commission on the History of Meteorology) - ID 24

Contribution ID: 64

Defining drought and understanding tropical climate: the place of meteorological observations in the understanding of weather stations in northeastern Brazil (1850-1920)

Almir Leal de Oliveira
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The starting point of the research was to identify how the tropical climate of Ceará (Northeast Brazil) was represented throughout the 19th century, by the duration of the monsoon: understood as a dry

period followed by a humid period. This definition was mainly based on a climate chronology, which identified, from historical records, the dry and rainy periods, where, for different periods, the climate was characterized as a climate marked by monsoons: highlighting the irregularity of the climate phenomenon and the chronic conditions of long dry periods. From the beginning of meteorological observations in Fortaleza in 1850, the climate began to be problematized with empirical information that diagnosed different precipitation areas in different geographies (*sertão*, coast and mountains). With the expansion of rainfall observations, the definition of drought was changed from a seasonal understanding of the climate to a more complex interpretation of the tropical region marked not by the absence of rainfall, but by their irregularity throughout the year. The network of rainfall stations established in Ceará in the early twentieth century changed the objective understanding of climate, seasonal precipitation periods, and defined drought as a complex meteorological phenomenon of rainfall irregularity in particular areas of this region. Through the analysis of these records of the tropical climate we follow the changes of climate interpretations of the region, characterized by the social thought of the period as an area devoid of a "good climate" and, therefore, as a space of difficult development of the productive forces.

Contribution ID: 36

Connecting Australia to the World: Darwin as a meteorological hub in the continent's tropics

Ruth Morgan
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In 1872 a small settlement on the north coast of central Australia became central to the extension of telegraphic communications between the colonies to the metropole, via the completion of the Overland Telegraph. At this settlement, Darwin (12.46° S, 130.84° E), the telegraph connected Australia to the world, while facilitating the reach and velocity of the communication of data that was vital for meteorological research. Both a conduit and a node for meteorological data collection, Darwin offered meteorologists insights into the workings of the continent's extremely variable climate and beyond, even though this tropical outpost was far from the well-established colonial capitals in southern Australia. Such was the settlement's rise to prominence that Australian meteorologist E.T. Quayle could declare in late 1928 that it "has come to occupy a position of singular importance in world meteorology, especially with regard to its air pressure records". The "singular importance" to which Quayle referred was the recognition among meteorologists of the significance of air pressure measurements at Darwin for the calculation of rainfall over eastern Australia, as well as the Southern Oscillation. Yet neither Quayle nor Darwin were much recognised for their roles in this regard until at least the 1970s in Australia or elsewhere. This paper examines Darwin's meteorological role in early twentieth century climate science, and the ways in which its geographic position on the edge of the continent shaped its relative neglect.

Contribution ID: 62

Joanne Simpson's hot tower hypothesis and the history of tropical meteorology: The atmosphere is stable -- except when it isn't

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This paper examines the contributions of Joanne Simpson to the field of tropical meteorology in the second half of the twentieth century.
Tropical skies cover half of the world's surface area and embrace fully half of the world's people. On a typical day, puffy white clouds and gentle sea-breezes predominate, yet the tropics are home to the most violent weather on Earth. By direct observation, experimentation, numerical modeling, satellite remote sensing, involvement in field programs around the world, Simpson discovered that giant cumulonimbus clouds, or "hot towers," are the driving force in the tropical atmosphere that provide energy to power hurricanes, and ultimately, the global circulation of the atmosphere. Leading meteorologists such as C.-G. Rossby and his contemporaries did not know this, but Joanne Simpson did.
Most works in the history of science and technology are not about meteorology, and most histories of meteorology focus on polar and temperate regions. With few exceptions, histories of meteorology examine the accomplishments of a cadre of male scientists. They also tend to marginalize or erase completely the contributions of female researchers. Joanne Simpson's work on the tropical atmosphere and her personal and professional struggles throughout her 62-year career did not fit this pattern.

Symposium (Part 1/2) Localising Global Technical Knowledge: Founders and Educators of Engineering Schools and Universities in Modern China, c. 1850-1950s (ICOHTEC) - ID 147

Contribution ID: 540

Training modern Chinese naval engineers in a French way: Fuzhou navy yard (1866–1907) and its educators and students

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Traditional Chinese scholars usually concentrated on learning Confucian Classics and had limited interests in technical knowledge. Training China's own naval engineers at Fuzhou in the late nineteenth century represents a significant turning point in elite education. After the Opium Wars, the Chinese official Zuo Zongtang established the Fuzhou Navy Yard in 1866, which aimed at mastering the apability of constructing modern warships independently. French advisers, engineers and teachers were hired, and a series of French schools for naval construction, dessin and apprentices were set up. More than 300 Chinese young men were enrolled in a five-year program and received trainings in language courses, requisite courses of mathematics and engineering, and practices in the factory. Only about half of them finished the training program, and the very few extraordinary ones were sent to France for further education.
Previous studies have almost exhausted the historical details about Fuzhou Navy Yard, but few of them discuss the training programs through a transnational perspective.
This paper focuses on examining the teaching programs practiced at Fuzhou Navy Yard and addresses the following questions: (1) How the programs "localised" the French "polytechnic system"? (2) What were their obstacles in training the Chinese teenagers without sufficient language skills and/or technical knowledge? (3) How was the quality of those graduates? And how about their careers? (4) What was

the influence of "Fuzhou Model" on China's technical education? The answers can shed new light on the localization problems of "French model" of technical education in the Chinese context.

Contribution ID: 165

Pioneers of Educating China's Technical Elites: An Official-Industrialist Sheng Xuanhuai (1844–1916) and His Educational Enterprises

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From 650 to 1905, the civil service examinations provided Confucian-trained literati with an entryway into officialdom in imperial China. The demand for training Chinese technical elites emerged and grew quickly when China's last empire was threatened by the western powers after 1850. Sheng Xuanhuai (1844–1916), a preeminent official-industrialist, was a founder and manager of many modern companies and banks, as well as several technical schools. His most significant contributions to the educational enterprises were establishing China's earliest polytechnics or engineering universities around 1895/6 by copying the U.S. university pattern: Peiyang University (forerunner of Tianjin University) and the Nanyang College (forerunner of Shanghai jiaotong University, etc.).
The existing scholarship on Sheng Xuanhuai has mainly focused on Sheng's role as official and industrialist. So far, only a few studies have addressed Sheng's influence on the Chinese education system. No in-depth study on his epochal reforms in China's technical education is yet available.
Based upon an intensive survey and archival research, this paper analyses Sheng Xuanhuai's advantages of carrying out pioneering technical education in the following aspects: (1) the previous efforts of Chinese educational reforms and the proper opportunity for Sheng; (2) Sheng's attitudes towards education; (3) his experience in managing industries and raising funds; and (4) Sheng's social capital, including his bureaucratic connections and network with foreign (missionary) teachers. Those aspects can further advance our understanding of how technical education, with special links with industry and political power, became a developmental strategy in modernising China.

Contribution ID: 261

The civil engineer Ling Hongxun (1894–1981) as an educator

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Thorben Pelzer, Leipzig University
The Civil Engineer Ling Hongxun (1894–1981) as an Educator
This paper provides a case study of early modern Chinese engineers' evaluation of theoretical education *vis-à-vis* the merits of actual engineering practice. Although a bridge engineer by education, Ling Hongxun (1894–1981) rose to fame through his timely completion of the Guangzhou–Hankou Railway in 1936. However, he was also a productive author of textbooks on a wide range of engineering fields. He published introductions to municipal engineering (*Shizheng gongchengxue*, 1924), railroad engineering (*Tielu gongchengxue*, 1925), bridges (*Qiaoliang*, 1929), and factory design (*Gongchang sheji*, 1933).

This opens the question about the relationship and potential hierarchy between construction and education. With the process of professionalisation still ongoing, there was no professional consensus about the desirability of career paths. For instance, Ling Hongxun's Chinese Institute of Engineers (*Zhongguo gongchengshi xuehui*), through its magazine *Engineering Weekly* (*Gongcheng zhoukan*, 1932–1937), inducted engineers into a "hall of fame" naming their engineering feats, but also their educational achievements.
Through an analysis of Ling's writings, I argue that although he promoted the importance of education, his own teaching career was the outcome of biographical changes and unswayable political dependencies. For Ling education, while not without merit, remained less desirable and secondary to material 'constructive' work.

Contribution ID: 909
Commentation and Discussion: Understanding Chinese Engineering Education in a Comparative Perspective (1)

Wolfgang König
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Our discussant Prof. Wolfgang König, an expert on the history of engineering education in the western context, will offer a comparative insight into our understanding of the Chinese pattern of engineering education.

Session IX - Meteorology

Contribution ID: 1064
Different views of scientific debate on climate change and its significance for public training

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Climate change is an important topic affecting all aspects of today's society, and the understanding of its scientific conclusions is the basis for concerted action of the international community. However, there have been some debates on some scientific issues of climate change. IPCC believes that human factors are increasingly becoming the main cause of climate change in the past century. The NIPCC, the opposition of IPCC, and S. Fred Singer, who are the key scientists and the most influential figure in the field of scientific debate on climate change. In general, NIPCC and Singer are against human activities as the main cause of global warming. They think that natural factors, especially solar activities (through cosmic rays, etc.) are the main cause of global temperature change.
After the report of NIPPCC was released, IPCC made a serious investigation, improved some improper points in the workflow, and made a positive response, and published Copenhagen Diagnosis. It's reasonable that IPCC's conclusions are questioned due to the high uncertainty of nature. Some of Singer's views are worthy of reflection and reference by IPCC and academic circles, which is the positive role of NIPCC. And listening to different opinions is conducive to the more scientific development of climate change research (Shaowu Wang, 2010). However, NIPCC and other objections also have obvious shortcomings.

These arguments show the importance of training in the public. Both politicians and ordinary people need training to truly understand climate change and put it into action to protect the ecological environment.

Contribution ID: 1074

Defender and Expositor of the Bergen Methods of Synoptic Analysis: Bergeron's "Three-Dimensionally Combining Synoptic Analysis"

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Tor Bergeron was a key member of the Bergen School of Meteorology that developed some of the most influential contributions to synoptic analysis in the 20th century: air-mass analysis, polar-front theory, and the Norwegian cyclone model. However, the eventual success of these so-called Bergen methods of synoptic analysis was not guaranteed. Concerns and criticisms of the methods—in part from the lack of referencing to prior studies, overly simplified conceptual models, and lack of real data in papers by J. Bjerknes and Solberg—were inhibiting worldwide adoption. Bergeron's research output in the 1920s was aimed at addressing these concerns. His doctoral thesis, written in German, was published as a journal article in *Geofysiske Publikasjoner* in 1928. Based on an accessible and annotated English translation, we provide a succinct overview of this seminal study. Major interlaced themes of Bergeron's study were the first comprehensive description of the Bergen methods; a vigorous defense of cyclogenesis as primarily a lower-tropospheric process as opposed to an upper-tropospheric/lower-stratospheric one; a nuanced explanation of the assertion that meteorology constituted a distinct and special scientific discipline; and, very understandably, a thorough account of Bergeron's own contributions to the Bergen School. His contributions included identifying how deformation results in frontogenesis and frontolysis, quantifying subjectively the influence of aerosols on visibility, and explaining the role of the ambient conditions in the onset of drizzle as opposed to rain showers—a distinction that led the formulation of the Wegener–Bergeron–Findeisen process.

Contribution ID: 1161

Reevaluating the roles of the Kaitakushi's Japanese assistant professors and officers in the history of meteorology

Kae Takarabe
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The Meiji Government considered Hokkaido a critical area for development and they planned to colonize and develop the region's agriculture by making use of American science and scientific advisors. Meteorology was crucial to this process. Takarabe (2020) explored the introduction of the Smithsonian Meteorological Observation System to Hokkaido. *Sapporo kisho hyakunenshi* (1976) shows "many people have contributed to the meteorological business in Hokkaido". It suggests that "there were particularly

hidden shadow meritorious persons" and names William Wheeler, Naritoyo Fukushi, Shinzo Kimura, Shichisaburo Mizushita, Chozaburo Kajimura, Matazo Yamabe, Sango Toyokura, Koji Abe, and Hiroki Nemoto, directly involved in Sapporo Weather Station. It also introduces achievement of Wheeler and Toyokura.
The purpose of this presentation is to examine how the Kaitakushi (Hokkaido Colonization Office)'s Japanese assistant professors and officers were involved in the process of creating meteorological knowledge. The focus will be on two little known Yamadas.
Masakuni Yamada, Mathematics teacher of Sapporo Agricultural College, was entrusted with meteorological observation during the absence of Wheeler and William P. Brooks, according to Wheelers letter on August 1, 1877.
Munehito Yamada, surveyor of Kaitakushi requested and obtained the information on why a difference in urban thermometric observation, through Wheeler's letter on January 21, 1878.
They were not just passive reservoirs of the science but actively engaged in applying and elaborating the science in local contexts.

Takarabe, Kae, The Smithsonian Meteorological Project and Hokkaido, Japan, History of Meteorology, 9 (2020).
Sapporo Regional Headquarters, Kishocho, *Sapporo kisho hyakunenshi* [100 Years' History of Meteorology in Sapporo] (1976).

Contribution ID: 1211

"Distributed authority and the global atmosphere: the role of telecommunications in late nineteenth-century international meteorology"

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This paper explores the influence of transnational telegraph networks in the disciplinary and epistemological development of late nineteenth-century international meteorology. Starting in 1860, the speed and circulation of telegraphic weather information enabled meteorologists to shift from compiling historical data to publishing daily predictive forecasts. Yet meteorology remained a quasi-professional practice even as networks of international weather communication began to expand and link together in the late 1860s. Working without any basic theoretical laws of storm prediction, observers employed a mix of vocational experience and statistical analysis to compile national forecasts. In 1872, the International Meteorological Organization attempted to oversee cooperation between national weather services and guide the development of shared procedural standards. Without formal political power, however, the IMO remained a voluntary association and struggled to manage the variety of meteorological practices across individual member states. Fearing a loss in membership if a specific system became mandatory, IMO administrators focused instead on expanding the geographical reach of the international observation network and facilitating a greater flow of information between individual sites. The internationalization of meteorology in the absence of centralized institutional control resulted in the decentralization and distribution of scientific authority across the ever-expanding network of stations exchanging global weather data. Issues of epistemological and structural ambiguity in international meteorology persisted even as the IMO's institutional scope continued to grow through the end of the century, presenting an important case in the history of debates over knowledge and authority in atmospheric science.

Symposium (Part 2/3) Reflections of science and technology in the Ottoman Empire: scientific interactions among various ethnic and religious backgrounds, societies and institutions - ID 437

Contribution ID: 618

The Birth of Modern Meteorology in the Ottoman Empire in the Second Half of the Nineteenth Century (1854-1894)

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The aim of this paper is to discuss the development of modern meteorology in the Ottoman Empire during the nineteenth century. Although the Ottomans had already been using weather prediction methods at sea since early times, the meteorology emerged a science in the Empire during the nineteenth century. The great storm of November 1854 during the Crimean War and establishment of the Istanbul Observatory in 1868 were two important stages of this process. However, the Ottoman meteorology remained for a long time in the service of a European network. The results of the Istanbul Observatory were published in French and transmitted daily to European capitals via telegraph. Therefore, their immediate utility for the Ottoman maritime and agricultural activities seem questionable. However, meteorology as a new science continued to develop through the Ottoman press, bringing to light a rich Ottoman Turkish meteorological terminology. Besides, meteorology education in imperial schools underlined the importance of weather prediction for navigation and agriculture. However, with the Istanbul earthquake of 1894, a noticeable shift of the scientific interest from meteorology to the geology field took place. Therefore, from the great storm of 1854 to the Istanbul earthquake in 1894, remembering that the initial progress in modern meteorology in the Ottoman Empire was mostly achieved within international networks, to what extent one can observe the development of a new local science in the Empire with local benefits? The present paper will answer this question especially through an analysis of Ottoman archive and press documents.

Contribution ID: 875

Buy or make dilemma in history: technology transfers and military innovations in ottoman empire during 18th and 19th centuries

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Technology transfer is not just buying a developed technology from another –and presumably more developed supplier and use it to gain an edge on militaristic –or civilian applications of said technology. Actually, technology transfer is the process of transferring scientific findings –or technology itself from one organization to another for the purpose of further development and commercialization. The process typically includes: Identifying new technologies. Protecting technologies through patents and copyrights. This process requires extensive research to define the usage and patterns of technology,

a willing partner who can give you the pathway and know-how, and most importantly capital to provide said technologies or scientific findings.
Starting with the 18th century, Ottoman Empire –and developing countries such as Russian Empire, United States of America and German Empire in the late 19th century, tried to use technology transfer as a method to compensate their shortcomings against the European rivals. Although Ottoman Empire is considered as one of the most successful countries to use militaristic technology transfer against its rivals, it failed to create a unique and valuable innovation to be patented and commercialized. Germany, however became the technology provider using a complex hybrid system of economic nationalism and capitalism. This can be attributed to many things such as traditionalism, constant budget deficits, institutions which failed to create individuals who can innovate, etc. But the main question remains: Are the governments and rulers unable to see the problem or they were just too powerless or too impecunious to do something to change it?

Contribution ID: 577
E-POSTER The Initiative on "Aerial Telegraph" in the Ottoman Empire

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The Initiative on "Aerial Telegraph" in the Ottoman Empire
Due to its advantages, rapid communication techniques have always attracted people's attention throughout history. These techniques have been based on vision and hearing until the invention of electrical telegraph. Just before the invention of the Samuel Morse (1791-1872) Telegraph, a system called "Télégraphe Aérien" was developed by a French engineer Claude Chappe (1763-1805) in France in 1793.
This technique, which has been in use for a short while in French territory and in some central European states, has attracted the attention of the Ottoman state in the same years. We do not have any information that this technique called "*Havai Telegraph*" by the Ottomans, was established and used. However, there is a book titled "*Risale-i Telegraph-i Havaiye*" in Ottoman Turkish concerning Claude Chappe's telegraph system. This manuscript is presently registered in the Military Museum inventory and has not been examined yet.
The purpose of my presentation is to demonstrate the reflection of "center-periphery" interaction on the spread of science and technology, adaptation of modern techniques by Ottomans from different cultures and traditions by means of the example of an aerial telegraph.

Symposium (Part 2/4) The materiality of knowledge circulation between China and Europe: physical formats, epistemic genres, spatial localities (16th-18th century) (ISHEASTM) - ID 32

Contribution ID: 100
Knowledge embodied in objects: the transformative circulation of enamel between Europe and China in the late 17th and 18th century

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During the Kangxi, Yongzheng and Qianlong reigns (1662-1795), enameled objects were luxury goods both in Europe and in China. They were traded as such between the two ends of the Eurasian continents, while pigments and techniques also circulated. This paper will present some of the first results of the EnamelFC project (funded by the French Agence Nationale de la Recherche), an interdisciplinary project that aims at studying these exchanges by combining the study of objects, of physicochemical data, and of archives. In particular, we will present our work on the archives of the Imperial Palace Workshops (*zaobanchu* 造辦處), which is based on the encoding of the archives materials produced during the three reigns of the three emperors mentioned above. We will discuss what can be learned about the ways in which Western (*xiyang* 西洋) patterns, materials and techniques were incorporated into the making of objects intended for imperial use, highlighting the communication and administrative procedures that underlay the production of objects, and the hybridization of elements of different provenances, including, but not exclusively, Europe.

Contribution ID: 51
Tracing innovations and technology exchanges between Europe and China. Enamelled objects at the 17th-18th century turn

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Enamelling, i.e. coating of a substrate with a layer of glass by firing, is one of the most sophisticated technologies developed to decorate artefacts. China has a long expertise in the production of ceramics and glass but for technical and aesthetic reasons, 17th century (Ming Dynasty and then Kangxi reign) Chinese decors were rather similar to those obtained on paper with lavish or watercolour techniques. These productions did not permit to represent a 'realistic' decor, as prepared on majolica, (soft-paste)porcelain and metal wares by European craftsmen who were capable of making copies of famous paintings. Actually, much information about the ingredients and production process remain imprinted in the matter accessible by advanced spectroscopical methods. The rareness and high value of artefacts, particularly those made at the Imperial Palace under the guidance of (Jesuit) European masters, require the use of non-invasive mobile instruments. We present here an overview of the analytical study of French (enamelled watches, Limoges wares, soft-paste porcelain, etc.) and Chinese (*wucai, fengcai, falangcai, huafalang, cloisonné* etc.) artefacts prepared during the 17th and first part of the 18th century (Qing Dynasty). We are able to identify the first use of European ingredients (blue As-rich cobalt, white cassiterite) and recipes (purple-red Perrot' gold nanoparticles, *Naples yellow* lead pyrochlore type pigments) for the preparation of 'realistic' decors on Chinese ceramics and enamels, which shed light on the technological exchange between Europe and China. The results are significant in terms of comparison with the written records analyzed by historians.

Contribution ID: 449
Samples, books and maps: the meandering routes of mineral knowledge between Macao and Paris

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By 1731, Jacques-François Vandermonde (?-1746), French surgeon in Macao, came back to Paris with a collection of Chinese minerals he had purchased from a local pharmacy. The collection of 79 mineral samples, recently rediscovered in the Muséum national d'histoire naturelle in Paris, was carefully labeled in Chinese characters, calligraphed by Vandermonde's local contacts in Macao. It also came with his French translation of the minerals section of Li Shizhen's *Bencao gangmu* 本草綱目 [Compendium of materia medica], detailing their medicinal and chemical uses. In the 1830s, as geology and minerology became independent disciplines of inquiry, this collection drew a renewed interest, with the Sinologist Édouard Biot (1803-1850) and the mineralogist Alexandre Brongniart (1770-1847) teaming together to cross-examine these samples with Chinese local gazetteers, in an attempt to map China's mineral resources. Reconstructing how these minerals were collected, labelled, shipped, mapped, and studied with textual sources in multiple languages over the span of a century, this paper discusses the complex interplay between material formats and knowledge-making in a cross-cultural setting.

Contribution ID: 71

The dissemination of western essential oil knowledge and distillation techniques in late Ming and early Qing China

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Perfume products were among the most important commodities along the Silk Road. Having been introduced into China since the Han dynasty, Western spices became very popular in the Tang and Song dynasties. In particular, rose oil made from natural plant through distillation or extraction was widely imported to China. However, the Arabic distillation techniques were not well mastered by the Chinese. In late Ming, Italian Jesuit Sabatino de Ursis provided detailed discussions on the medical function of essential oils and related distillation techniques in *Taixi shuifa* 泰西水法 (Hydromethods of the Great West, 1612), from which Chinese literati learned the distillation method and made many different kinds of essential oils from flowers or herbs. Through text and practice, Chinese finally mastered the production and various uses of essential oil.

Symposium (Part 2/4) Placing mathematical knowledge in a world of and beyond nations (IASCUD) - ID 454

Contribution ID: 830

From the local to the global: connecting the evolution of statistical thought and practice in eighteenth century Europe

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This paper takes a two-pronged approach to the history of statistics in the eighteenth century. First, it analyses the changing methods of data collection used by practitioners of statistics. It argues that changing practices and methodologies, such as the use of wider networks of informants, desire for more empirical and numerical information and the need for more efficient ways of gathering and analysing this information, created a need for a more mathematical, precise and scientific methods of collecting statistical data. Second, it analyses the changing definitions and methodological approaches of statisticians throughout the eighteenth century. It illustrates how new practices, definitions, and theories were developed through networks spread across Europe, defined not by single geographical spaces but by a wider 'pan-European' even global space. This opened statistical thought to a myriad of new ideas that helped transform it from a purely descriptive enterprise to a fully-fledged mathematical science. The paper argues that local practical experimentation drove higher levels of theoretical developments in the history of statistics, as international/global statistical communities negotiated and renegotiated the practical and theoretical implications of data collection and analysis. It explores the relationship between the local and the global and how their combination was an integral components in the evolution of statistics. Taking examples from Scotland, Germany, Switzerland and France, this talk demonstrates how the changing practices of statistics were brought about through diverse international communities who were experimenting with new methods in their own backyards.

Contribution ID: 711

International mathematics in literature: the Oulipo's mathematical connections

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The OuLiPo (Ouvroir de Littérature Potentielle, loosely translated as the Workshop of Potential Literature) was founded in 1960 by Raymond Queneau and François Le Lionnais and included a group of members who straddled humanistic and scientific domains. Throughout its more than six decades of existence, this experimental literary collective has received worldwide attention for its unique use of mathematics as a prop for literary creation. Specifically, many scholars focus on the Oulipo's ties with the mathematical collective, Bourbaki. Given the group's popularity and peculiar longevity, the question arises as to what role its use of mathematics has played in its operations and reception. Indeed, beyond Bourbaki, members of the Oulipo have dealt with a wide range of mathematical disciplines, inventing rules for literature based on set theory, algebra, combinatorics, and geometry as well as creating some of the first examples of electronic literature on early computers in the 1960s and 1970s.

In this paper, I aim to develop a genealogy of the Oulipo's mathematical influences, demonstrating the international connections that have enriched this unique group's literary production. While some have criticized the Oulipo as using mathematics in a purely metaphorical way, perpetuating an image of experimental literature that was ultimately unfeasible, I contend that the group's commitment to mathematics as a model is both legitimate and sophisticated and has far-reaching implications for the reception of the group's potential literature.

Contribution ID: 895

Emphatic adverbs, proper nouns, and the disciplinary grammar of international mathematics

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Mathematicians' efforts in the first half of the twentieth century to build international institutions matched to their universal ideals were marked by considerable political and logistical obstacles as well as fundamental disagreements over the meaning and aims of internationalism. My presentation will examine the language of international and internationalist mathematics, focusing on how shifting grammar and rhetorical forms reflected and helped to constitute new scales of political and intellectual engagement. I will discuss, in particular, the emphatic adverb "truly" found in such forumations as "truly international" to describe mathematicians' aims and ideals. American mathematicians and their European interlocutors in the first half of the twentieth century used such adverbial expressions to navigate rapidly shifting geopolitical terrains and negotiate the status and significance of mathematics and mathematicians the world over. Their adaptations and compromises left a lasting mark on the terms and achievements of international inclusion, cooperation, and hegemony in mathematics. At the same time, new scales and infrastructures of exchange gave new significance to proper nouns, including eponyms, , and institutional signifiers. I will trace the changing roles of proper nouns in marking and connecting communities and ideas in a globalizing discipline, linking the grammar of attribution and identification to fundamental conceptual and theoretical shifts in the mathematics of the first half of the twentieth century. I will conclude by suggesting some methodological and historical links between these analyses of adverbs and nouns, with consequences for the historiography of modern mathematics.

Symposium (Part 4/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 207

Contribution ID: 425

A matter of trust and control: Questioning the precision of 'precision clocks' in 18th-century observatories

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All observatories need precise clocks, because within astronomy 'just about everything depends on the correct going of the clocks'. This pithy judgment by the Berlin-based astronomer Johann Karl Schulze (1749-1790) raises a number of questions regarding the interaction between clocks, astronomical instruments, and astronomical practice. Fundamentally, when did a clock perform 'correctly'? According to which criteria was it checked, and in how far did its going influence the quality of astronomical observation? Surprisingly, these questions are far from settled.
This paper outlines a research project at the Mathematisch-Physikalischer Salon of the Staatliche Kunstsammlungen Dresden that examines the technical quality as well as the handling and monitoring of clocks in a number of 18th-century observatories across Central Europe. Furthermore, the project seeks to develop robust statistical methods in order to quantify the degree of precision reached by the clocks.

In association with the Department of Mathematics at the University of Siegen, it proposes parameters that enable comparison across the widely varying schemes used to control the clocks. This variety corresponds to differing knowledge and a diversity of opinions regarding the construction of clocks, which included a profound distrust in technical advancements 'on grounds of the unreliability of all these inventions'. The project thus analyses the development of precision standards, while at the same time highlighting the frayed limits of that very notion.

Contribution ID: 295

Determining, keeping and transmitting time. A century of famous and forgotten precision clocks at the Neuchâtel observatory (1858-1958)

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The Cantonal Observatory of Neuchâtel was founded in 1858 to respond to the watch industry's needs for precision. In this talk we will examine a century of evolution of cultures of precision, considering the link between two protagonists who are "experts" in the field of time measurement: the astronomer and the watchmaker. Collaboration between the two, both international and local, is simultaneously necessary for the Observatory and a source of potential conflicts over the definition of precision.
This work is based on an analysis of the Observatory's sources, particularly reports and correspondence with manufacturers, crossed with the material culture of the technical instruments, some of which are still preserved in the Musée international d'horlogerie (MIH) in La Chaux-de-Fonds. We will discuss mechanical clocks, the vacuum electric clock developed by Matthias Hipp in the early 1880s to reduce climactic variation, and the use of quartz clocks from 1948. In addition to precision clocks (including examples by Winnerl, Zenith, Riefler, and Leroy) we will discuss how other types of instrument and the observatory environment itself were managed to understand and control shifts in the timekeepers' daily rates. Key moments and clocks, whether reputed or forgotten, will be examined to grasp the issues that lead to considering a clock, which was previously suitable, as imprecise and in need of modification or replacement.

Contribution ID: 1023

Under the microscope: Making minerals visible in mineralogy and popular science in modern China

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The revolutionary roles of the microscope in understanding properties and nature of materials in Europe have been recognized, but symmetrical analyses of the introduction and use of microscopes in non-Western contexts remain few. This paper explores the relationship between microscopes and the production and circulation of mineralogical knowledge in late Qing and Republican China. When introduced into China in the late nineteenth century, mineralogy was presented in the form of translation, independent of the microscope, the scientific instrument crucial for its development in Europe. These translated works however had to incorporate the knowledge acquired through lenses in laboratories and illustrate it with texts and images. The use of microscopes in mineralogy proved its

significance by the last years of the Qing, when new generations of mineralogists returned from overseas and initiated anew education and research of mineralogy in laboratories, research institutes, and universities. Microscopes were hence integrated into systematic studies of minerals as the essential equipment for identifying and classifying them. They produced outcomes appearing in textbooks, treatises, reports and popular publications, and gained a close connection with the mineralogical knowledge. Through the connection, microscopes generated a new mode of visibility of minerals, expressed in textual descriptions and pictorial illustrations, which served to secure the accuracy and science in mineralogical knowledge; yet at the same time, the visibility of minerals was proliferated in various forms along with the development of printing technology, and further reinforced the modern conceptualization of mineral in both the scientific community and the broader public.

Contribution ID: 338

An Oscilloscope and a Life: the Beginning of China's Electronic Measuring Instruments Field

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Before the 1950s, China had no R & D capabilities in the field of electronic measuring instruments and no related industries. In 1956, Professor Zhang Shiji (1929-1994) established the first radio measurement major in China in the Chengdu Telecommunications Engineering College (CTEC, now the University of Electronic Science and Technology of China). He translated and wrote the earliest textbooks in Chinese in Electronic Measurement, Radio Measurement, and Microwave Measurement Instruments. His students established themselves in universities, research institutions, and manufacturers around the country, becoming the backbone of the field. His lab self-developed the first generation of oscilloscopes in China. Serving as the chairman of the Automatic Testing and Control Society of the Chinese Electronics Society, he pioneered the -helix structure "one school – one factory – one institute" in the field, forming a the CTEC, the Qianfeng Instrument Factory, and the NO. 14 Research Institution of China Electronics Technology Group. As a result, in the 1970s, China was able to independently develop 200 series of electronic measuring instruments and a typical case was oscilloscope. With an annual output of more than 30,000 units, they were used in communications, broadcasting, and other fields to meet the needs of the entire Chinese electronics industry.
This research will focus on the process of Professor Zhang Shiji's development of China's first generation of oscilloscopes and track how China's electronic measuring instruments field started from scratch with his efforts.

Session VIII (Part 2/2) - Gender

Contribution ID: 1171

Identity and Experiment: Female Psychologist's Reflections on Identity and Their Role in Experimental Styles, Germany 1920s

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In the last decades historians of psychology have discussed the roles of female psychologists in academic contexts. As these contexts were dominated by men and the first female students were often viewed with scepticism, women often reflected very intensivly on their role as scientists while attempting to make a career as psychologists. I want to ask whether and in what form these reflections played a role in shaping different experimental styles in the psychological experiments of female psychologists in Germany during the 1920s.
In my first case study I want to analyse the ideals of "scientificity" which Franziska Baumgarten, a Swiss psychologist with a Polish Jewish background, developed. Baumgarten has been one of the most productive psychologist of her time but later fell into oblivion. She conducted experiments precisely on norms of societal cohesion (like veracity, justice and so on). In her papers one can find a reflection on femininity, science, and society in form of a fictional autobiographical novel entitled *Die Studentin*.
In my second case I want do to dicuss the experiments and theoretical reflections on female identity presented by the psychologist Martha Muchow. Muchow was a prolific researcher in the field of psychology and included specifically the research subject "female idenity" in her experiments: In 1928 she presented a research on the identities of female teachers and students.
In a concluding section I present a reflection on the question as to what forms of influence the identity discourses of these two psychologists had on their experimental work.

Contribution ID: 1224
Breaking borders: a case of Victoria Lady Welby

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The personality and ideas of Victoria Lady Welby, which are the focus of our attention, fully reflect the theme and issues of this congress and can be described as a set of oppositions. Lady Welby was born in the year of the beginning of the "Victorian era", was the godchild of Queen Victoria, but completely violated the boundaries of the image of a woman of the Victorian era. Lady Victoria Welby belonged to high society, but her occupation was not charity, but scientific research. Without a systematic education, she creates significs as a new science of meaning, which can be put on a par with other semiotic and semantic ideas (Peirce's, Breal's, and Ogden's ones). Not belonging to any formal institutional structure, Victoria Welby, thanks to her numerous correspondence, creates an informal club, often serving as a bridge between various scientists and their ideas, which can be compared to the activities of the famous Marin Mersenne. Not being a scientific giant or the founders of a scientific school, Lady Welby had a direct or indirect influence on her contemporaries, among them Pierce, Ogden, members of the significs movement in the Netherlands. Significs' ideas are in tune with the ideas of the Vienna Circle and the terminological movement, and it can be regarded as a predecessor of some later theories (for example, TSA). Now is the time to rethink and reassess the ideas of Victoria Lady Welby's significs. (The reported study was funded by RFBR, project number 20-011-00261)

Contribution ID: 1227
Anne Conway on monads

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The concept of monad is to such extent central to the philosophy of Gottfried Wilhelm Leibniz that in philosophical circles the word is immediatly associated to the great German rationalist thinker. However, as Leibniz himself stresses, the idea of a spiritual atom of sorts, something between the conceptions of Plato and Democritus, was communicated to him by one of his most notable correspondents, English philosopher Anne Conway (1614-1687).
Even though she was closely tied to the "Cambridge platonists", Anne Conway's masterpiece "The principles of the most ancient and modern philosophy" was only published anonimously and after her death. In this paper I outline the concept of substance exposed in the book: in the first part, I address Conway's critique of Cartesian dualism, and in the second part I present her conception of monad. In guise of a conclusion, I discuss the important differences between Conways's and Leibniz' conceptions, stressing how Conway's views seem more interesting from our Antropocene standpoint.

Contribution ID: 1238
Science After the Suffragettes: Trouble at T' Mill for Irene Manton

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Gender inequality remains a pervasive and persistent global issue. This essay addresses the problem in the historical scientific setting, through its focus on the British botanist and cytologist Irene Manton, FRS, (1904–1988), a leading researcher in the evolution of ferns who later made fundamental discoveries in cell structure with the electron microscope. The patriarchal institution of science has naturally been perceived alienating to women, who have encountered challenges in reaching its upper echelons as well as territorial restrictions to areas traditionally occupied by men. This essay uses Manton's career as a lens for examining both the opportunities and the challenges for women in British science, after the changes brought in by the suffragette generation. Manton represents the rare case of a woman in science, who was in a position of leadership in a modern university after WWII. It is from this vantage point that Manton sought to work with the electron microscope, an area that, until then, had by and large been occupied by men.

Symposium Marxism and the history of science: new perspectives - ID 22

Contribution ID: 40
Quantum and materialist dialectic: dynamic and statistical regularity in Hessenian Marxism

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In this paper, I will discuss the significance of dynamic and statistical regularity in the development of Soviet philosopher, Boris Hessen's dialectical materialist approach to the history of science. Best-known for delivering a paper entitled "The Social and Economic Roots of Newton's 'Principia'" in 1931, Hessen maintained that the content of Sir Isaac Newton's natural philosophy was traceable to forms of socioeconomic development and technological progress specific to 17th-Century England. The paper was profoundly influential in the founding of the broader schools of the Sociology of Scientific Knowledge and Science and Technology Studies. However, Hessen's other writings were characteristically different from this paper, as in the Soviet Union, he was engaged in a fierce defense of quantum mechanics---considered incompatible with Soviet Marxism at the time---, along with the autonomy of natural scientific research. By drawing on studies of newly-translated texts, however, I argue that Hessen's 1931 paper and writings on quantum mechanics are not only compatible, but illustrative of his unique approach to the dialectical materialist study of the history of science. Hessen not only uses his understanding of quantum mechanics to posit the history of modern science as one of an ongoing unity in opposition between dynamic and statistical regularity, but as a way of re-imagining the dynamics between socioeconomic base and ideological superstructure within Marxist theory. Ultimately, Hessen marshals this argument into a compelling scientific defense of the need for socialist politics to foster democratic, collaborative approach to natural scientific research with non-Marxists.

Contribution ID: 421

Criticism of machinism and modernity

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During the first half of the twentieth Century we can find a very interesting "reactionary" criticism of machinism and modernity, which is also sometimes a criticism of capitalism as destroying traditions, peoples or even nature. However this criticism includes Marxism in its definition of modernity: Marxism is seen as another way of submitting the world to the destroying logic of machinism, most of all after the Russian Revolution. Through the texts of these "reactionary" I will question the relationship of Marxist thought to modernity and machinism, underlying the ideological question of progress.

Contribution ID: 74

"Edgar Zilsel and the Critique of the Mechanical conception of Nature"

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Edgar Zilsel (1891-1944) was one of the most interesting Marxist intellectuals of the Vienna Circle. In his sociological project discussing the social roots of modern science, Zilsel examines the role of the tool makers, technicians and artisans in the birth of modern science in the period preceding the Scientific Revolution of the 17th century. This forms the base for the famous "Zilsel thesis" which has attracted researchers' attention in the recent years.
In my presentation I will discuss his essay "The Problems of Empiricism" which is the work connecting his sociological project with his philosophical project examining the concept of the physical law and in

particular I will elaborate on Zilsel's description of how the experimental method and the concept of law compounded to form the metaphysics of the mechanistic worldview.
My special focus is on the final section of this essay: "The decline of the Mechanical conception of nature", where Zilsel describes how the mechanistic worldview fell apart giving way to a new non-reductionistic conception of reality. I will further comment on Zilsel's assertion that the dominance of mechanical technology led to the ideal of the causal deterministic law while the rise of the electrical and chemical industries helped establish a non-reductionistic conception of causal law.

Contribution ID: 38
Engels, plagues and 19th century epidemiology

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Friedrich Engels (1820-95) was Karl Marx's closest collaborator and therefore considered a giant of Marxist philosophy and political theory. However, his contribution on questions of science, ecology and nature has sometimes been criticised. Some assume that he had nothing substantially different to say than Marx on these questions. Others accuse Engels of introducing a positivist influence that was alien to Marx's own thought in that it lacked a dialectical understanding of the subject-object relation.
This paper will challenge these conceptions by addressing Engels' engagement with the social epidemiology of his time, expressed in works such as *The Condition of the Working Class in England* (1845) and *The Housing Question* (1872). As this paper will demonstrate, Engels' ideas changed as he engaged with contemporary scientific discoveries such as the germ theory of disease. In his writings, Engels described how economic conditions created a niche that enabled dangerous pathogens such as cholera to thrive. By referring to "social murder", the way in which the bourgeois demand for profit exposed workers to conditions that they could not hope to survive, he anticipated discussions of structural violence that became common-place in global health over a century later. This paper concludes that Engels' work links the social and the ecological in a manner that is far from the mechanical materialism that he is sometimes associated with.

Symposium (4/7) 16th Annual Symposium of the Social History of Military Technology (ICOHTEC) - ID 127

Contribution ID: 199
The cordite case: understanding the inner technological issues in an otherwise social-legal legacy

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During 1888-1891, Frederick Abel, a veteran British War-Office chemist and James Dewar from Cambridge, led a government committee for examining better alternatives to black powder, as from the then new, smokeless propellants family.

Alfred Nobel, who patented smokeless Ballistite in Britain 1888, sent samples, judged by both (early 1889) as ballistically unstable, due to a volatile ingredient, camphor. Nobel was notified. Being allowed to improve candidates' formulations, both improved Ballistite themselves, ending with Cordite's initial patent, mid-1889. Nobel disengaged, making until 1891, significant process and compositional changes, as removing camphor. Cordite was also upgraded

Some view Nobel as being used and Cordite almost illegal, meant for profit. An 1894 trial though, ruled that Nobel's patents did not cover Cordite. Even if for profits, both could hardly rationalize Cordite, without Ballistite's prematurity and quick British needs. As with Abel before, duty and patenting seem intermixed. In early 1860s' he enabled safe, military nitrocellulose use, by upgrading a foreign-patented, problematic process, patenting his upgrade in 1865.

Cordite followed Ballistite's novelty of incorporating nitroglycerin in smokeless powders, in addition to nitrocellulose. Yet the mixing process followed Nobel's 1875 Blasting Gelatin patent, where nitroglycerine and nitrocellulose were mixed with volatile organic solvents, later removed. Both probably preferred Gelatin's proven method over Ballistite's, where nitroglycerine and nitrocellulose were mixed with camphor and passed unconventionally through hot rollers, obtaining a "carpet", cut into flakes. Cordite much differed in other aspects, as extruding the mixture into tubes to be dried, burning more efficiently than Ballistite flakes.

Contribution ID: 139

Victorian science meets the reality of industrial war: H.S.S. Watkin and rangefinding and the Royal Artillery, 1870-1918

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From the 1870s through the 1910s, British inventors developed numerous rangefinding instruments for use by artillerymen and infantry in war. The rise of what M. Norton Wise has termed "the value of precision"—as if such needed to be enunciated, but it did—presaged an intensification of the relationships between the military, science, and inventors developing instruments for use with artillery and ordnance in this period. Rangefinders appeared based on diverse methods to triangulate distances and precisely measure artillery elevations and some became commonly available while others remained nearly unique. While a few of the inventors were civilians, most were initially part of the military establishment. Notable among them was Henry S.S. Watkin, who will be the main focus of this talk. Watkin eventually became the Chief Inspector for Position Finding for the Royal Artillery at the end of the century and developed a number of astoundingly interesting range finding instruments, even though his work is strangely occluded in the official records. The talk will compare the solutions he developed in the 'mekometer' and the 'depression rangefinder' and how these and otters instruments were assessed by the British Army at the turn of the century, as well as how inventions by military men were (or were not) in circulation in the larger community of British instruments and invention.

Contribution ID: 1121

E-POSTER Re-evaluating Britannia Bridge: The Historical Development of Bridge-building Technology

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Britannia Bridge, considered one of the greatest engineering achievements of the Victorian era, was constructed by Robert Stephenson with rectangular tubular girders in 1850.

Rosenberg and Vincenti praised the technology of the bridge, noting that knowledge of Britannia Bridge was applied to other engineering works (e.g. Fairbairn's tubular crane) in the mid-nineteenth century.

Conversely, arguing that efficiency, economy and elegance made civil engineering structures artistic, Billington noted that Britannia Bridge entailed excessive material and money and assessed it as not being a model of structural art. Similarly, Petroski characterised Britannia Bridge as a failure, both economically and environmentally.

These two historical evaluations of the same bridge reflect no consistent perspective on the history of technology. I review the history of bridges based on their successive structures: Girder, suspension, arch, truss, and cable-stayed bridges. However, the suspension bridge has the longest span; longer-spanned bridges have not been developed. Where then is Britannia Bridge to be positioned in the history of bridge-building technology?

The tubular bridge was in the forefront of mid-nineteenth century technology, but soon became old-fashioned as bridges emerged in which the ceilings of the rectangular tubes were removed to save material, after which the truss bridge gradually replaced the tubular structure. Britannia Bridge bridged the transition from the girder to the truss structure.

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Contribution ID: 1155

E-POSTER Situation of the fight against malaria in Peru (1953)

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Malaria has been and will continue to be one of the most dangerous endemic diseases for humans. With news of its existence since prehistoric times, its expansion through the tropical areas of the different continents makes it a deadly weapon if adequate care is not taken for its containment and eradication. In Peru its existence has not been alien, since from the viceregal era cases of infection by *Plasmodium* had been notified. However, it will only be the medical revolution in the twentieth century that will effectively control the disease and its vector.In view of the outbreaks of the disease today, this work arises, in which the beginnings of the directed antimalarial fight will be exposed. from the state, in this case during the government of General Manuel Apolinario Odría, who ruled Peru between 1948-1956, using the year 1953 as a reference year, the year of the publication of the official journal of medicine "Health and Society" of the then Ministry of Public Health and Social Assistance, which, in its first numbers, presents us with the panorama of the state's fight against malaria and the real state of the disease in the country, together with statistical data that allow us to make a reconstruction Accurate history of contagious disease eradication practices in Peru in the 1950s.

Contribution ID: 1214

E-POSTER The origins of the Russian study of Chinese astronomy. Russian astronomer of the 19th century K. Skachkov on the history of Chinese astronomy

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The first links between Russian principalities and China date to the 13th century. From the 16th c., Russia sent ambassadors to China, who made a description of the country. In the 17th century, a Russian Orthodox mission was founded, led by Father Maxim Tolstoukhov. In the 18th century, scholars at the Petersburg Academy of Sciences took great interest in the history of Chinese astronomy sent by the Jesuit mission in China. In 19th century, the Orthodox mission in China began to carry out wider functions – trade, diplomacy and science. Petersburg academy sent students to study various aspects of life in China, laying the foundations of Russian sinology. In 1848, St-Petersburg academy founded in Beijing a magnetic and meteorological observatory, headed by Konstantin Skachkov, who lived in China for 25 years and made extensive studies of the history of Chinese astronomy. Skachkov not only learned Chinese, but also studied many old manuscripts on astronomy. He wrote the study "The fate of astronomy in China" (1874). Our research question is to show the pioneering role of Skachkov in the formation of historical and scientific research in Russian Sinology. After Skachkov, Chinese astronomy was studied by G.N. Popov (1920), A.V. Marakuev (1934) and E.I. Beryozkina, who translated "Mathematics in nine books" into Russian (1957) and published a monograph on the history of Chinese mathematics, 1980. In 2009, the five-volume encyclopedia "The Spiritual Culture of China" was published, with detailed articles by V.Ye. Yeremeev on the history of science, including astronomy.

Contribution ID: 1221

E-POSTER SCIENTIFIC RESEARCH, INNOVATIONS AND LABOUR PRODUCTIVITY IN BRITISH AND RUSSIAN MANUFACTURING BEFORE THE GREAT WAR

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First, using data from official manufacturing censuses, we compare labour productivity in Great Britain and the Russian Empire around 1908. We find that Russia's labour productivity was at 81.9 per cent of the U.K. level. Russia's productivity was on a par with France's and significantly superior to Italy's. We also find that the majority of Russian industries underperformed British ones. However, the industries that had been established or modernised during the state-induced industrialisation policies of the 1890s, such as the Southern metallurgy and some branches of mechanical engineering, performed on a par with their British counterparts. Russia's alcohol, rubber and petrochemical sectors outperformed their British equivalents.
Second, using data from the database on the history of Russian science, we find a strong correlation between the innovation activity of Russian companies and the level of their labour productivity. As an example of such innovative activity, we examine individual enterprises of the Russian rubber,

petrochemical, alcohol industry, mechanical engineering and shipbuilding. The activities of their research laboratories and interaction with universities are also considered.

Contribution ID: 1223
E-POSTER Stanisław Michalski - the founding father of the science of science

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Stanisław Michalski (1865-1949), Polish educational and scientific activist, believed that theoretical reflection, which is considered as a part of - as he called it - "knowledge of science" (1923) or "science of science" (1929), should be undertaken simultaneously to the working practices for the development of science.

He presented this program in the yearbook "Nauka Polska Jej Potrzeby, Organizacja i Rozwój" ["Polish Science: Its Requirements, Organization and Development"] (1918-1947), founded and edited by him, which was a forum for the science of science.

Michalski initiated the work of the Science of Science Seminar (1928) at the Józef Mianowski Fund - an Institute for the Promotion of Science. He intended to transfer these activities to the international forum. This is evidenced by the initiation of the journal *Organon* (1936).

Michalski also designed the creation of an Institute for Science of Science of the international composition and reputation. This initiative had no counterpart at that time in any other country.

Although Poland was not a political, economic or military power, thanks to Michalski's efforts, it had the opportunity to obtain the status of a "giant" of scientific reflection about science of science among other countries.

The authority obtained in the scientific community and contribution to the development of science justify assigning Stanisław Michalski the title of "giant" in science, although if he were still alive, he would not agree to this term, because he was a modest man.

Contribution ID: 1231
E-POSTER Halley's Comet Trail: Transit and Legitimation of astronomical knowledge in Chile (1910)

Verónica Ramírez-Errázuriz, Patricio Leyton
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This work describes how theories related to the 1910 Halley's Comet circulated at a local and a global level. It explores how they affected the process of legitimization of astronomical experts and the development of science audiences in Chile. Likewise, the work demonstrates that the transit of this

knowledge was produced through the deployment of an editorial market in this period dedicated to celestial phenomenon. The theoretical perspective considers the history of science and focuses mainly on the relevance of the public. The sources of this study consist of printed texts published in Chile during these years, especially journalistic projects of wide coverage and distribution, which started circulating at the beginning of the 20th century, thanks to the modernization of the publishing industry.

Contribution ID: 1329
Uncovering Hidden Stories in the Archives of Learned Societies

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Speaker bio: Ray Abruzzi is the Publisher for *Wiley Digital Archives*, a program to digitize the archival holdings of learned societies and other institutional repositories. Ray has over 20 years' experience in academic publishing, and has been working for over a decade to make primary sources accessible to students, educators, and researchers, partnering with over 300 libraries, archives, and other institutions around the world to digitize primary source collections. Ray is a member of the *Center for Science and Society*, the Executive Editor of the *Columbia Journal of History*, a research associate on the *Making and Knowing* project, and a consultant on *History Lab* at Columbia University in the City of New York.

Symposium Lives in danger, workplace in decay... „Ordinary" intellectuals of Jewish origin and their fate between 1930s and 1950s. - ID 715

Contribution ID: 987
A Treasure of the USHMM Archive: Dr. Ilka Dickman

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Keywords: holocaust, archive, Wahington DC, refugee
The USHMM (United States Holocaust Memorial Museum) in Washington DC, USA, is not only a place of the holocaust victims' remembrance. There is also an archive gathering various kinds of resources.
During my presence in 2019, I had the opportunity to study resources related to Dr. Ilka (Ilke) Deutsch-Dickman. The story of her life is unique: she fled from Czechoslovakia to avoid Nazi persecution and settled down in the USA. In the meantime, her father, rabbi Aladar Deutsch, the last chief rabbi of Prague, was suffering in Theresienstadt. Ilka came back to Europe with the US troops as a major of the Public Health Service to help multitudes of people imprisoned in the camps across Germany. She was only one small screw in a machine, but she was high by her endeavor and determination. In terms of gender, she broke the stereotypes and foreshadowed the future role of women in society.

The fund that carries her name contains many types of documents; it is voluminous and well organized. Many such funds are deposited in the archive, offering inspiration and precious data to researchers. The USHMM database of victims gathers personal data held by all the other archives worldwide.
The purpose of my contribution is to share my experience with this archive and present my work dedicated to the personality of Ilka Dickman.

Contribution ID: 988
Transformation of the students and pedagogical staff of Prague universities in the second half of the 1930s

Ivana Ebelová, **Milada Sekyrková**
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Contribution ID: 989
Institute of Light

Vira Gamaliia, Svitlana Ruda
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Key words: ophthalmology, eye diseases, pathogenesis, cataracts.
Traditions in medicine are almost more important than in other fields of knowledge. It concerns in particular Filatov's Odessa ophthalmic school. Its tradition was successfully continued by Nadegda Puchkovskaya (1908-2001).
Graduated in 1930 the Kiev Medical Institute as ophthalmologist, Nadegda Puchkovskaya defended her thesis devoted to the regeneration of corneal tissue in 1937. But in a short time her father, Alexander Puchkovsky, a talented scientist-physician, was unjustly arrested and shot. On this reason she was fired from job. Only after Stalin's statement that children are not responsible for the fathers, she received her job back. However her activity was interrupted by the Second World War, when she led the eye department in the front hospital. From 1946 and until the end of her life Puchkovskaya worked in Odessa Institute of Eye Diseases, based by V. Filatov (in 1957-1985 she was its director). In 1971 she became a full member of the Academy of Medical Sciences of USSR.
Puchkovskaya is author of more than 300 works on the treatment of eyeball injuries, the study of the pathogenesis of severe eye burns and their consequences. She has created an original direction in ophthalmology, has developed a number of new operations in the anterior part of the eye, method of transplanting the cornea with cataracts. She prepared 27 doctors and 26 candidates continuing the tradition to return light to people.

Contribution ID: 990
German-Jewish scientists and their fate between 1933 and 1960

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Keywords: scientists, mathematicians, exile, emigration, scientific work, styles of thinking, labour conditions, integration
Shortly after the beginning of the Nazi regime in Germany a great wave of emigration committed. Scholars and scientists, physicians, engineers, mathematicians were displaced from their positions in schools, colleges, universities, hospitals and research institutions. All were forced to leave and had to go into exile. Among the "Displaced German Scholars", as they were labelled in the booklet published in 1936 by the AAC (Academic Assistance Council) in London, were left-wing intellectuals as well as conservative scientists. They had to adapt to a new culture and to integrate themselves in a new science and education system. All tried to transfer their knowledge and capacity to the new country under these different conditions. From 1938 on they had to emigrate again from all European countries under Nazi occupation and together with colleagues from these countries who were persecuted by the Nazis too. Based on my research about displaced scientists - female and male - from Kaiser Wilhelm Institutes and the Berlin University (Vogt (2007, 2008, 2011, 2014)) and mathematicians in exile (Vogt (2009, 2012, 2015)), first I'll describe the situation of success or failure in exile, what does success mean and why the adaptation and integration could fail. Second, I'm discussing five conditions - apart from the language problem - which were necessary to be able to continue the scientific work under new labour conditions, in new institutions with different rules, styles and traditions. Very often émigrés had to change their research field or scientific interest to be able to adapt to the new conditions. Third, I'll illustrate these five conditions for the continuation of scientific work in new countries by giving examples of emigrated scientists and mathematicians who escaped to UK, Soviet Union, France, the Netherlands, to Palestine and the USA. Only very few came "back", and I'm discussing the problems and reasons that only few scientists returned to their home institutions in a now divided Germany.

Symposium (Part 2/2) Under Tropical Skies: Relocating Giants and Dwarfs in Meteorology (International Commission on the History of Meteorology) - ID 25

Contribution ID: 37

The world of filipino weathermen of the manila observatory and the philippine weather bureau, 1884-1935

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The development of meteorology as a science in the Philippines was both a by-product of the initiatives of the Jesuits in Manila and the work of the local Filipino personnel of weather service in the Philippines. During the formative years of institutional meteorology in the 1860s-1870s, several native staff were already part of the laboratory work and scientific missions of the Jesuits. When the weather service was officially established by the Spanish colonial government in 1884, they were hired as government employees and served as observers, calculators, and draftsmen. Their work was highly technical, as they were tasked to do numerical and mechanical observations and calculations. They received salaries from the government at the rate that can be considered for middle-class earners.
This paper attempts to explore the professional life of some personnel of the Observatorio Meteorológico de Manila (1884-1901) and the Philippine Weather Bureau (1901-1935). On the one hand, it will analyze

how a form of apprenticeship emerged between the Jesuit scientists and administrators and the Filipino technical staff of the weather service, as well as on how they contributed to knowledge production. On the other hand, it attempts to portray and discuss how these native staff negotiated work and identity in the context of progressive science and servicing the colonial state. To mention one, notable was the government career of Torribio Jovellanos, who served as weather observer and weather station manager from the 1880s up to the 1930s.

Contribution ID: 35

Just doing their job: The Hidden Meteorologists of Colonial Hong Kong c. 1883-1914

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This paper investigates the contribution of the employees of the Hong Kong Observatory from its inception and into the early twentieth century. Their contribution to the nascent scientific service has hitherto been hidden behind that of the histories and personalities of the observatory director(s), yet, without them, the service could not have functioned or grown. While the glimpses of their work and lives are fleeting, often only revealed in minor archival references, this article seeks to interrogate these sources to make visible their invisibility. While acknowledging the difficulty of limited resources, I contend that absence says more about the attitudes of the colonial officials towards their subordinate staff, than it does about the ordinary workers themselves, especially in terms of race and gender. However, rather than offering a simplistic account of official colonial prejudices, it argues that although we know little about these people's lives, that their high turnover, complaints, instances of foot dragging, or their tenacity to continue for years under difficult conditions, says much about the ability of the worker to reject or to negotiate colonial patriarchy. In highlighting something of their stories, this article sheds light on the everyday cultural and social contexts of colonial meteorology but, also, the important role of the ordinary workforce in producing meteorological knowledge at this time.

Contribution ID: 377

Rainfall prediction in post-colonial South Asia: The connected projects of astrology, folklore, and meteorology, 1948-1963

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The uncertainty of timely and adequate rainfall is a perennial concern for agriculturalists in tropical monsoon climates. In South Asia, where crops are primarily rain-fed and annual precipitation is distinctively concentrated during the four months of the south-west monsoon (June to September, roughly the *chaturmāsa* of the Hindu calendar), the political implications of meteorological prediction are cast into sharp relief. This paper examines the politics of rainfall prediction in the newly independent nation-states of India and Pakistan after 1948, where astro- and agro-meteorological forecasts competed with statistical projections offered by the India Meteorological Department (IMD, f. 1875). In this paper, I examine two genres of vernacular publication: collections of agricultural proverbs—which in Bengal were commonly grouped together as *khanār bacana*, literally the "sayings" of the sage Khona—and the ever-popular *pañjikās* (almanacs) whose typically high-caste claimed their calculations accorded

with the ancient brahminical knowledge of *jyotiḥśāstra* (astrology). Despite significant methodological differences, experts practicing within each tradition shared the value of foretelling the character of the season months in advance. Thus, all stood in contrast to the "engineering" solutions advanced by the dominant developmental agenda. Ultimately, the paper argues that while rainfall predictions' *accuracy* was important in bids to establish authority by astrologers (like Anulkrishna Goswami), folklorists (like Sankar Sen Gupta), and meteorologists (like S. N. Sen), assertions of *authenticity* and *history* were equally vital. Taken together, these productions constituted a multi-centered, pluralistic project to domesticate weather science for the region.

Contribution ID: 1297

Dwarfs or Empire Builders? Italian colonial meteorology between the Mediterranean and the Indian Ocean

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At first sight, tropical meteorologists are dwarfs of the history of science. Intellectual histories of science have often overlooked them as mere collectors of data, or at best as peripheral actors in a world history of science still conceived of as a set of (European) centers and colonial peripheries.
To the contrary, colonial meteorologists were key empire-builders. Half-scientists and half-explorers, their work was fundamental for the establishment of colonial states, for agricultural production and for warfare. What features made the scientific knowledge produced by these actors such a pervasive part of European scientific and environmental imperialism in Africa? Their ability to learn from local population, the portability of their expertise across geographical spaces, and their skills as coalition builders allowed often allowed them to connect as distant areas as the Mediterranean and the Indian Ocean.
My presentation focuses on Italian colonial meteorologists, as their work was critical for the success of Italian imperialism in the arid environments of Libya, Somalia and Eritrea. In particular, the meteorologist Amilcare Fantoli started setting up weather stations in Tripolitania as military officer in 1919, was promoted Chief imperial meteorologist in the interwar period, and even returned to Africa during the Italian Trusteeship of Somalia for the U.N. (1950-1960). By looking at his ubiquitous scientific activities as those of an empire builder rather than as a dwarf of the history of science, the paper emphasizes the coproduction of Fantoli's scientific data and the changing socio-technical imaginaries of Italian colonialism in Africa.

Symposium (Part 2/2) Localising Global Technical Knowledge: Founders and Educators of Engineering Schools and Universities in Modern China, c. 1850-1950s (ICOHTEC) - ID 148

Contribution ID: 898

Promoting and Localising Mechanical Engineering Education in Modern China: Liu Xianzhou (1890–1975) and His Pioneering Educational Practices

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Liu Xianzhou (1890–1975), a native of Hebei Province in northern China, who studied mechanical engineering at the University of Hong Kong, was a distinguished scholar in mechanical engineering and a pioneer in developing modern Chinese mechanical engineering education. Throughout his career working at the most prestigious engineering universities in China, including as the President of National Peiyang University (1924–28) and as professor at Tsinghua University for more than 40 years, Liu Xianzhou made extraordinary innovative efforts to develop Mechanical Engineering Education (MEE) in a Chinese way. He is more widely known as a scholar with outstanding works on the history of Chinese ancient mechanical engineering than as an educator.
From a perspective of studying the history of scholarship in MEE, this paper provides a comprehensive survey of Liu Xianzhou's contributions to China's MEE by exploring the four major aspects: (1) his early engineering educational practices and, in particular, advocating for the concept of cooperative education (i.e., the "work-study cooperation" program); (2) his teaching programs for promoting and localising MEE in the Chinese context; (3) compiling the dictionary "English-Chinese Mechanical Engineering Terminology" to standardise Chinese terminology in mechanical engineering; and (4) producing Chinese textbooks for MEE. Moreover, those aspects discussed above reflect a native Chinese thought and concepts of promoting engineering education, which can give an insight into the trajectories of MEE adapted in modern China.

Contribution ID: 197

Educating Chinese Textile Students between Theoretical Knowledge and Practice: A Comparative Case Study of U.S.- and France-Returned Teachers at Peiyang/Tianjin University in the 1950s

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In the early years of the liberation, the textile higher education in northern China was mainly provided by the Textile Department of Peiyang University (which was later renamed and is known today as Tianjin University). That textile department was founded in 1947 in Tianjin by the former Textile Alumni of Peking University, and evolved into the Hebei Textile Engineering College in 1958 (renamed as Tianjin Textile Engineering College in 1967; known today as Tianjin Polytechnic University). As a branch of engineering education at Peiyang/Tianjin University, textile education was often mentioned in various literature. However, the history of that textile department and textile education in particular, has been rarely studied. This paper focuses on two selected teachers at Peiyang/Tianjin University in the 1950s and examines the role of educators in the textile engineering education. In particular, it highlights the influences of returned students on the transformation of textile education. The two selected examples are Zhang Duoshan, dean of the department of textile, and Zhang Hanwen, teacher of wool textile, respectively. The former was a returned student from the U.S., and the latter returned from France. Their different educational backgrounds led to slightly varied teaching styles by emphasizing theoretical knowledge or practices. Nevertheless, their efforts, such as making teaching program, producing textbooks, and training teachers, proved effective in educating China's new generation of textile experts.

Contribution ID: 679

Debates on traditional architecture in China: Uncovering the layers of the reception of Liu Dunzhen

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When looking for literature on traditional Chinese dwellings one can't oversee the treatise *Zhongguo zhuzhai gaishuo* (*Introduction to Chinese Dwellings*) published in 1957 by Liu Dunzhen (1897–1968) and translated into French under the title *La maison chinoise* in 1980. Liu Dunzhen studied in Tokyo mechanical engineering and architecture, before returning to China in 1922. In present-day Chinese reception he is considered as a pioneer in the historiography of traditional Chinese architecture and the related restoration practice, especially in applying modern (i.e. Western) methodologies – methodologies that he learned from his Japanese teachers, but he applied from a "Chinese perspective". What are the sub-texts and counter-claims, and who might be the (hidden) counter-actors in such a claim?

The present study reconstructs the historical background which frames this assessment focusing on the political and highly ideological campaigns of the "Hundred Flowers" (1957) and the Great Leap Forward (1958–1960/62). Both campaigns affected seriously the relations with and among Chinese intellectuals, and formed the background of Liu's criticism against his colleague Liang Sicheng (1901–1972). Indeed, the development of the relations between Liu Dunzhen and Liang Sicheng – alumnus of the University of Pennsylvania, and founder of the architecture department at the Northeast University in the late 1920s – may be read as a blue print of the ideological climate in that period, and can serve as a leading thread for uncovering the several layers that constitute the assessment of the contribution of Liu Dunzhen to the history of traditional architecture in China.

Contribution ID: 910

Commentation and Discussion: Understanding Chinese Engineering Education in a Comparative Perspective (2)

Wolfgang König
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Our discussant Prof. Wolfgang König, an expert on the history of engineering education in the western context, will offer a comparative insight into our understanding of the Chinese pattern of engineering education.

Symposium (Part 2/5) Re-scaling & de-centering the history of oceanography: the 'hidden figures' and hidden dimensions of global ocean science (ICHO) - ID 453

Contribution ID: 945

Debating Value and Purpose: The Inland Ohio- Mississippi River System within Broader Water Networks

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In the nineteenth and twentieth centuries, the inland Ohio- Mississippi River system was incredibly important to the economic and urban growth of the United States. As an interstate resource, the government grew as become the primary "caretaker" of the river. This may appear to simplify responses to the river system's ecological needs, but economic and commercial purposes dominated the thoughts and actions of government officials. This prioritization influenced the creation and dissemination of knowledge regarding the river. The U.S. government's knowledge of flooding, for example, related to commercial activity- not necessarily population centers.
By the early twentieth century, over a third of Americans lived within this and these groups became the primary repository for ecological knowledge of the waterway. As the land along the riverbeds are vulnerable for flooding, marginalized groups, whether in the form of shanty communities or "River Rat Row," were essentially forced to live in these areas. Marginalized groups intimately knew the river, from its navigation to sanitation issues to seasonal variability, yet race and class impacted the dominant view regarding the value of this knowledge. It often resided within the river communities themselves. The state blamed these communities for the degradation of the riverway, but as residents, they were often incredibly invested in the health of the riverway. This paper seeks to prioritize the local activism and creation of knowledge amongst marginalized groups along the river, often whom worked within the river and had their own ideas regarding the ongoing re-engineering of the waterway.

Contribution ID: 764

Vulnerable at Sea: Environmental-Health and the Maritime Environment

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Maritime histories of early-modern Peru traditionally focus on trade, commodities, contraband, and the Transatlantic Slave Trade. However, the maritime environment was more than a conduit to the Americas, it was a distinct environment with its own environmental-health properties. This paper asks how early-modern travelers thought about the Ocean environment and its influence on corporeal wellbeing. In the sixteenth century, oceanic travel was arduous at best. Ship crews weathered storms, food shortages, dehydration, and illness. Whether across the Atlantic or along the Humboldt Current, sea travelers found themselves in a vulnerable position. Many ships traveled with physicians, but medical staff were also at the mercy of circumstance: would there be enough provisions, medicine, and knowledge on board to treat the ill? It was precisely this fear, the fear of the unpredictable maritime environment, that deterred Crown-appointed Viceroy Pedro de La Gasca from venturing to sea. But in 1546, the rumors of bloodshed and political unrest could no longer be ignored. Despite La Gasca's protests, Charles V forced him to embark on a mission to quell Peru's rebellious factions. Based on an examination of the Pedro de la Gasca collection housed at the Huntington Library, this paper argues that the emotion of vulnerability shaped how Iberian men and women interpreted their health and prospects in a diverse range of environments including on a ship in the middle of the Atlantic Ocean, off the coast of Chile, or in subtropical highlands of Cuzco.

Contribution ID: 589

De-centering conservation in the Indian Sundarbans Delta: a nexus between global ocean science and competing grounded environmentalities

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River islands have remained reasonably understudied in maritime studies, largely exploring representative categories like 'maritime', 'coastal', 'riverine' etc. We argue that historical temporalities add significant explanatory power to the discourses on southern maritime frontier landscapes. The Sundarbans Delta, connecting the Ganges and its numerous distributaries offers ideal space for a vibrant historical maritime research. Sundarbans have witnessed temporally complex neoliberal transitions in conservation and natural resource governance in tune to mainstream ocean science over the last few decades. Being acclaimed as the UNESCO World Heritage Site for its unique physical attributes – biodiversity, wildlife and marine resources, the contemporary conservation practice and climate science is aided by a range of sub-national and global bodies, scientific expertise and academic think tanks, big international NGOs and supra-local civic agencies, state government, transnational monetary organizations and other small and large corporations. Despite a range of proximate natural threats and physical vulnerabilities due to land subsidence as part of the sea level rise, prompting trans-local conservation attempts, predominant environmentalities reinforced embody standard ocean science and big data discourse. Legitimized on grounds of efficacy and formalistic knowledge and management practices, these interventions obscures spatial conventionalities of resource and disaster management – methods more fitting than what their outward orientation suggests. In this paper, we explore competing environmentalities, decentring relegated normative histories to current postmodern maritime epistemologies. We offer interpretative historical frames of spatial stewardship knowledge in eco-vulnerable marine ecologies, opening up significant scope in harmonizing them with formalized conservation frameworks.

Contribution ID: 646

Knowing the beast: how different styles of population modelling developed in early fisheries science

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Fisheries biology has always had a dual identity: it is clearly an environmental science, dealing with how fish populations and individual fish thrive or decline; and it is a science directed to commercial and economic ends, to maximize profits for producers and ensure a sustainable source of protein. In its early years, there was similarly a tension based on the scale of focus. On the one hand were scientists who desired to understand "the beast" – the life histories of individual fish species and population responses to environmental changes. Other scientists preferred to deal with commercial fish population changes in relation to fishing intensity. The International Council for the Exploration of the Sea was formed in 1902

as scientists urged governments to investigate whether industrial fisheries were depleting fish populations. Even during the earliest meetings there were disagreements on what kinds of data were required, how to identify overfishing, and how to measure this condition. Investigations on life-histories and the environmental background, such as those by Norway's Johan Hjort and his Canadian protege, A.G. Huntsman, had both small-scale and very high-scale dimensions. Mathematical-population studies, often based on commercial data, could arguably be described as being mid-scale, and were followed by scientists such as Denmark's C.G.J. Petersen, Germany's Friedrich Heincke, England's E.S. Russel and Scotland's D'Arcy Wentworth Thompson. This paper will explore the question of whether there were identifiable national aspects to research choices, and the historical factors that drove differences in the scale and focus of investigations.

Symposium (Part 3/3) Reflections of science and technology in the Ottoman Empire: scientific interactions among various ethnic and religious backgrounds, societies and institutions - ID 602

Contribution ID: 753

Ottoman temporality: towards an understanding of multivalent and multi-cultural temporal reckoning in early ottoman history

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The history of Ottoman time and temporal reckoning remains an understudied yet rich field at the intersection of the history of science and cultural history. While studies abound on the development of timekeeping technologies and the astronomical principles underpinning *ilm-i mîkāt*, these discussions inevitably claim some version of the notion that pre-modern conceptions of time were entirely religious and simply followed natural rhythms. Few scholars attempt to historicize what was understood to be a natural rhythm, let alone question how these rhythms manifested in the experience and performance of time in cultural settings, or what I refer to as *temporality.* Finally, studies of Ottoman time have tended to ignore the multitude of non-Turkic/Islamic calendars and temporal registers used by Armenian, Greek, or Jewish communities that contributed to the richness of Ottoman time. In this paper, I set forth a new way of thinking about the history of Ottoman time in the 15th–17th centuries that pays attention to the practice and social dimensions of temporality in settings such as the medreses, coffeehouses, and Istanbul's soundscape more generally. I argue that an overemphasis on the Islamic calendar conceals the importance of, among others, the Anatolian Rumi calendar, which was in use form the earliest days of the Empire, contrary to common belief. Finally, I call for the inclusion of non-Muslim communities within the understanding of what should be considered Ottoman Temporality.

Contribution ID: 996

E-POSTER The Existential Struggle of The Printing House Against The Verbal Culture and Manuscript Tradition in The Ottoman Empire

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Before the printing press entered into the Ottoman society, oral tradition was prevalent. The memorization of the Quran, for example, was more popular than the Quranic writing. The Ottoman alphabet consisted of Arabic letters - some specifically introduced for Ottoman Turkish- and had approximately 450 separate forms. Printing the alphabet was technically challenging. Because there were relatively few literate people in the Ottoman Empire at that time, printed books were not in demand. Manuscripts were in larger numbers and preferred to printed works. Ibn-i Sina, printed in Istanbul bookstores, for example, was not sold for a long time, despite the beauty of its print, low price, and its handwriting resemblance. Manuscripts of the same work were sold quickly at expensive prices. According to some Ottoman historians, the reason why printed works were not accepted in the Ottoman society is that these works were printed in Europe in Arabic letters in a crude way, and did not appeal to the aesthetic feeling of the East.Furthermore, having a library full of manuscript books was an important status symbol among the Ottoman intellectuals. The style and decoration of these books as well as their content expressed their value. Manuscript writing was a profession and livelihood, and copyists (transcibers) were seen as living printing press. It took time to get used to the printing press, and it was only accepted with the development of the letter casting technique.

Contribution ID: 1013
E-POSTER Theoretical Backround of "ilm al-misaha" (science of measure) in the Ottoman Classical Period (1300-1800)

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`Ilm al-misāḥa (science of measure) is a branch of mathematics which can be defined as applied geometry in modern mathematics and its scientific origins are based on Ancient Greek civilization. The use of `ilm al-misāḥa in this form goes back to the 9th century of Islamic Civilization. Its close relationship with areas such as construction, urbanism, architecture, decorative arts, geography and military engineering makes it the field of mathematics that touches the physical world the most. The Ottoman classical period was the period in which basic sciences, especially mathematics, were the least subject to academic research. Moreover, such an issue has never been studied in an interdisciplinary research. For all these reasons, a project is carried out under the auspices of TÜBİTAK (The Scientific and Technological Research Council of Turkey). The project has two phases of purpose: Firstly, determining the position, properties, values and journey of the studies on area and volume calculations (`Ilm al-Misāḥa) through primary sources in the Ottoman Classical Period (14th-19th century) within the Ottoman mathematics tradition and secondly, showing the reflections of these studies on the fields of architecture, decorative arts which were complementary elements of the architecture of the period and military engineering through visual materials. The purpose of this paper is to share the outputs of the first phase of the mentioned project.

Contribution ID: 1012
"Ilm al-misaha" through applications: a study of al-misaha manuscripts in the ottoman classical period (1300-1800)

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Ilm al-misaha is a branch of classical mathematics that examines methods of measuring the length, area and volume of geometric shapes in terms of a certain quantity, and applications of these methods to the physical world. This measurement is performed in a predetermined unit of measure represented by a continuous or discontinuous quantity. Two different meanings of measurement arise in this definition: Determining measuring methods of lengths, areas and volumes of line segments, surfaces and objects is a theoretical activity. Using these methods to measure the size of the entities in the physical world is an application of this theory. So, the study is divided as theoretical measurement and applied measurement.
Various manuscripts have been written in the field of *al-misaha* during Ottoman clasical era. Most of these works contain measurement problems related to daily life as well as theoretical information on *ilm al-misaha*. In this respect, these works constitute a convenient example of the application of theoretical measurement methods to religious, social, administrative and military needs, as well as application of proof-based knowledge to the physical world in the Islamic mathematical tradition.
In this work, we will present some examples of applications of geometric measurement in the framework of the project "Location, characteristics, value and course of area and volume calculations in Ottoman classical period mathematics, and their reflections in architectural and military studies". This project is funded by TÜBİTAK (The Scientific and Technological Council of Turkey).
Keywords: ilm al-misaha, applied geometry, measurement of area and volume.

Symposium (Part 1/5) Computing in the sciences and in technology. An Aristotelian perspective (HaPoC) - ID 11

Contribution ID: 78
Rockets, Engines, Biohybrids: 21st Century Motor and Temporal Regimes

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Of all the things that human beings attempt to optimize in themselves and their environment, one may be the very emblem of our era: the goal of overcoming the organism's temporality. Bodies come into being and bodies die. Processes in the body obey their own temporal regime. They are perfectly synchronized, multidimensionally orchestrated, a delicate fabric of overlapping timescales. Yet, research in the field of microrobotics and precision medicine has recently turned to a parameter very difficult to manipulate by nonsynthetic means: speed. The aim is to create "rockets" or "microjet engines," nanoscale synthetic motors able to move through the body at speeds far surpassing that of cells, motor proteins, or microorganisms. For these rockets to be able to hurtle through the body's interior, they have to remain compatible with their natural milieu, human cells; and they have to run on nontoxic fuels—biocompatible and biodegradable substances. Whether or not rockets will one day move inside our bodies is yet unknown. It is certain, however, that rockets operate on a timescale more akin to the twenty-first century observer than the imperceptible viscous flow inside our bodies. In this paper, I

argue that motion marks the beginning and the end of organic time. I will show how, by controlling motion, technology sets about commanding time.

Contribution ID: 256

Conspicuous computing. Organizing the cutting edge of computability (1980-2020)

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Over the last four decades, High Performance Computing has been a very dynamic field of techno-scientific practice. This is an astonishing observation. Huge investments became necessary in order to keep clusters of standard workstations at arm's length. Moreover, the dramatic increase of electric energy drawn by massive parallel processors as well as the noteworthy decrease of growth rates in processor speed suggest that the end of Moore's law is dramatically changing the perspectives for the HPC-field. The complex allocation procedures for projects, the burdensome management of big computing facilities, and the need for highly specialized programming skills, turn High Performance Computing into a thorny and extremely cost intensive techno-scientific endeavor. Sure, High Performace Computing offers beautiful and miraculous case studies without precedent. They are, however, often without review and follow up, and their scientific contributions – in terms of methodological innovation – remain relatively modest. This is certainly true if compared with computing systems that run way below the benchmarks and budgets of supercomputers but offer computing support for a big scientific community rather than a small group of scientific end users. Curiously enough, such manifest deficits of the HPC-field form the inexhaustible source of its distinctive power and charm. HPC-Centers allow governments to set up exclusive platforms nobody else might want to pay for and to run. It is these Centers' uniqueness, their astronomical costs, and their limited usefulness that turn High Performance Computing Centers into an attractive opportunity for what I call conspicuous computing.

Contribution ID: 595

Mainframe computer or programmable pocket calculator? Two calculation tools for two epistemological approaches of computing in French medieval history (1967-1981)

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In 1967, the Centre de Recherches Historiques of the VIth section of the EHESS launched a collective study dedicated to the development of the medieval cities in France between 1200 and 1550. Regarding the lack of archives for this period, historians chose to base their survey on a census of all mendicant orders. Their hypothesis was the following: the urban fact was directly correlated to the development of the mendicant convents. In order to follow this path, they elaborated a statistical analysis with the help of mainframe computers and computer scientists.
A few years later, one of the participants of that first investigation, Alain Guerreau, proposed another work based on the exact same hypothesis and the exact same source, but with a rather different approach. As he was opposed to the division of labor implied by the uses of mainframe computers, he proposed his own individual study based on the use of a programmable pocket calculator. He also chose

to use a probabilistic approach rather than a frequentist one, and did several correspondence analysis (a multidimensional statistical operation).
This paper proposes a comparison between these two studies in order to outline how different computing tools implied different computing practices. The analysis will focus on four main points: the social organizations of these studies, the choice of the computing tools, the differences between the two methodologies adopted by the actors and the different types of texts used in each contexts.

Symposium (Part 3/4) Placing mathematical knowledge in a world of and beyond nations (IASCUD) - ID 456

Contribution ID: 824
The Malthus Library: The library as cognitive instrument in the making of the population principle

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Thomas Robert Malthus (1766-1834) is infamous for his argument, made in the first edition of his *An Essay on the Principle of Population* (1798) that population growth would always outstrip food production. In this paper, I will investigate how Malthus's justified his population principle as a universal bio-mathematical law in the larger and more complex later editions of the *Essay*. Most of the materials Malthus assembled to write the second 1803 edition of the *Essay* are preserved at the Old Library, Jesus College, Cambridge. Malthus used that assembly of books and maps as an instrument with which to look across the early nineteenth European, American and Pacific worlds. What he had originally only supposed he was now able to present as a universal principle. Assembling materials to provide an empirical foundation for a universal truth would become an established practice in early nineteenth-century Cambridge. Two of Malthus's closest Cambridge friends William Otter and Edward Daniel Clarke were key figures in the founding of the first lasting Cambridge scientific society, the Cambridge Philosophical Society (CPS), a body known for its collecting practices. And George Peacock, a fellow CPS founding member, would justify his principle of equivalent forms as the foundation for English algebra through the collection of materials and reports from around the world. In my paper, I will argue that when Malthus assembled his library of materials to justify his population principle as a universal bio-mathematical law he prefigured what would later become a characteristic nineteenth-century English mathematical practice.

Contribution ID: 664
The Kitchen and the Dacha: Productive Spaces of Soviet Mathematics

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After World War II, under various political and institutional pressures Soviet mathematicians often shifted their work activities to informal settings. Instead of public spaces, mathematics was frequently

practiced in private or semi-private spaces – in home kitchens, at summer dachas, during nature walks, at individual meetings with volunteer mentors, or at seminars that were not part of the formal educational system. It is fruitful to compare this process to what David Kaiser has dubbed "the postwar suburbanization of American physics," when American physicists moved to suburbs, becoming increasingly alienated from their colleagues. If an American suburb becomes a symbol of alienation and rampant consumerism, the Soviet dacha in the postwar period embodies the idea of escape from urban routine, the notion of freedom, and a friendly company. Instead of being a refuge from work, for many Soviet mathematicians, the dacha became their primary working space; a place where they did their research, met with students, and exchanged ideas with colleagues. We might call this dacha-nizaiton of Soviet mathematics - the emergence of a community dedicated to mathematics far beyond any formal work duties or study requirements, a community practicing mathematics as a "way of life."

Contribution ID: 876

Internationalization and the interplay of theory and experiment in 1970s high energy physics

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The early 1970s, a period also known as the détente, were marked by a paradigm shift in HEP. On the eve of the November 1974 revolution, which brought the quark hypothesis to the forefront of particle theory, experiments were conducted to confirm the Regge theory, another candidate for the theory of strong interactions. However, with the paradigm shift, the sharing of physics research outside of the new mainstream—what soon became the standard model for particle physics—became negligible. I argue that one of the reasons the previous theories—based on reggistics and actively developed, in particular, by the Landau and Pomeranchuk groups in the USSR—rapidly lost the support of the scientific community was the total internationalization of big science at particle accelerators. In the mid-1950s, the CERN (France/Switzerland) and JINR (Dubna)—and, from the early 1970s, also the Fermilab (USA)—were still independent centers of scientific thought and experimentation. Later, through, focusing on the international and interpersonal nature of scientific theory and seeking to minimize costs through the division of labor, the entirety of HEP found itself in a situation where the combination of efforts caused by internationalization led to a narrowing of the scale of theoretical thought. The entire world's experimental machinery was canalized on the confirmation of the now-dominant standard model. Only the contemporary development of string theory suggests that the reggistics that lost the support of the community was not a dead end but one possible entry into a more fundamental theory.

Contribution ID: 879

Can mathematical knowledge be a form of self-knowledge? The case of the late Russian Empire.

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This paper relates the highly improvisatory use of mathematics at the turn of the twentieth century to a traceable cultural heritage within the Russian Empire of mathematics "connecting the sciences of the

outer world with the sciences of the inner world" (Bugaev 1868). Situated within an epistemic culture imbued with a gnoseological twist, the more acknowledged question in the Western history of philosophy of whether mathematical objects were invented or discovered was tacitly sidestepped. Instead, mathematical objects were recruited and developed for disciplinarily ambiguous questions around the category of *poznaniye*, or knowledge-acquisition, learning. This reflected an insistence on building a mathematical intersubjectivity where the cognizing subject was situated. We suggest that the "invention" of mathematical objects in practice was regarded as a method correlated to a "discovery" of structures within self.
Looking at various logical investigations before the Revolution, the noted omnipresence of mathematical objects troubles the historiographic separation into different "logical schools of thought" and signals a relation to math underexplained by efficiency, utility, or even rationality.
Besides examining popularizing mathematical texts and practices by Nikolai Bugaev, Aleksandr Vasiliev, Samuil Shatunovsky, we also consider the *New Logic* written by Nikolai Lange, who makes a case for logical maneuvers such as comparison, distinguishing, abstraction, definition, classification resting on our ability to perceive sameness, difference, equality, or novelty in the first place. Regarding laws of logic as reflective aids for decreasing the distance between self and the self-that-observes-self must be seen as the epistemic foundation for mathematical research of the time.

Symposium (Part 5/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 209

Contribution ID: 310
The transformation of a failed scientific instrument: a tool for teaching science, a work of art, and an inspiration for art

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In this case study, I will extend earlier conversations at SIC symposia about failed scientific instruments, and explore ways in which a failed scientific instrument can nonetheless enjoy great success. Making use of the concept of *chaîne opératoire* from anthropology and studies of material culture, I will examine the life cycle of the 200" (500 cm) diameter telescope mirror made for Mount Palomar in California (and now on display at the Corning Museum of Glass in New York). I will examine the reasons for the initial failure of this iconic scientific instrument, and show how the same causes of that failure have since made it a useful, even spectacular, tool to teach a subtle scientific point. Moreover, those same factors have inspired stunning works of art, some obviously, some subtly. The various connections between science and art in this case study are rich and deep. Are such connections unique? Can this case study serve as a model for other failed instruments (or even successful examples)?

Contribution ID: 442
Show, don't tell: the magic lantern and 19th-century science popularisation

Trienke van der Spek

Teylers Museum, Haarlem, Netherlands

The magic lantern played an important role in science communication in the 19th century and became the most popular visual tool for science teachers and popularisers. From big theatres to small lecture rooms: the magic lantern enabled new, inspiring ways to present scientific information to larger audiences, which transformed teaching and public lecturing.
Jacob van Breda, director of Teylers Museum, acquired a state-of-the-art magic lantern with double projector in 1861 from A. Krüss in Hamburg in 1861 for his lectures on astronomy and geology. A close study of this instrument as well as the accompanying slides and Van Breda's lecture notes gave insight into how the citizens of Haarlem were taken on modern, multimedia journeys through space and time. It also revealed the origins of the most imaginative set of slides provided by Krüss with the lantern.
This set is related to a popular geological show that Paul Hoffmann, magic lantern performer and science populariser, presented from 1858 onwards in a Viennese theatre. The slides include his dynamic, 'live' visualisation of earth's formation according to Laplace's nebular theory, geological illustrations and images of prehistoric life. The set is most probably by Hoffmann's hand: he is known to have been supplier to the Krüss company.
This paper presents the origin, use and context of the Krüss projector in Teylers' collection and illustrates how the magic lantern was used to transfer scientific knowledge in the mid-19th century.

Contribution ID: 287
Play, design, science: spinning tops, crossing spaces, understanding physics

Artemis Yagou
Deutsches Museum, Munich, Germany

Crossing disciplinary spaces lies at the heart of the work of designer duo Ray and Charles Eames (1912-1988 and 1907-1978 respectively). They continue to inspire designers all over the world but are perhaps less known among the scientific community, despite their highly original contributions to the popularisation of science. In this presentation, I would like to highlight their seven and a half minutes film *Tops* (1969), which communicates the physics of gyration. Avid collectors themselves of tops from numerous cultures, they used items from their collection to illustrate the universal laws of gravity and motion. The end result is a mesmerising short film about a fascinating artefact that has been crossing physical and intellectual spaces throughout history. Think of Pieter Bruegel the Elder's *Children's Games* of 1560 where children experiment with various types of tops at a town market square; James Clerk Maxwell's 1857 "dynamical top" presentation at the Royal Society in Edinburgh illustrating advanced concepts connected with rotating bodies; and different kinds of tops exhibited today in childhood and play museums all over the world. The humble top appears as an exemplary object for the range and variability of spaces for instruments. Furthermore, the history and usage of tops suggests the significance of cross-disciplinary approaches in museological and educational practice. The presentation will discuss these issues, supported by rich visual material.

Contribution ID: 968
No future without history

Jan Waling Huisman

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Science is about learning, the experience of discovering something new. Professors at the university teach students, historically by books and the oral circulation of knowledge. Trough the growing influence of the study of nature and its phenomenons the need for experiments in science grew. But should these knowledge and experiments be confined inside the walls of a university? With this talk I will try to show the importance of spreading knowledge to a general public, by performing the same experiments that have been performed for ages to enlighten upcoming academics,
It seems only logical that a university museum has a role in this. Not only do we give information about our collection, we also put the real instruments to use in lectures for the general public and educational projects for primary and secondary schools inside and outside the museum. For example, in 2013 we used several early 20th-century instruments from our museum in a working educational display at the centenary exhibition of the Medical Research Council at Imperial College London.
When giving these lectures and demonstrations using instruments inside and outside the museum on a regular basis the use of replications is imperative. We had some 19th century electrical devices replicated, this turned out to be so successful that we have received a generous grant to have some more experiments remade and to build a secondary school teaching program around this. This program will start in 2021, and will involve the early years of electricity and electromagnetism,

Symposium (Part 1/3) Evolution of mathematics in China: major figures, anonymous contributors, and the giants among them (ICHM) (with IMU) - ID 66

Contribution ID: 341

Concerning Classical Chinese Mathematics, We Only Know a Few Bits and Pieces

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Classical Chinese mathematics occupies an important position in the world history of ancient mathematics, but we only know a few bits and pieces. From the Xia Dynasty (21st-century BCE) to the compilation of the Nine Chapters on the Art of Mathematics in the Western Han Dynasty, a period of about 2000 years, mathematics underwent considerable development. There are some mathematical propositions in the Mojing (Mohist Canons) and in the Qin and Han dynasty mathematical bamboo slips excavated in the past 30 years. However, none of these goes beyond the content of the Nine Chapters, and they do not include such significant achievements as methods of finding square and cube roots, and for solving simultaneous linear equations.
In the 13th century, Qin Jiushao introduced the general dayan method for solving linear systems of simultaneous congruences, which reached the same level as Carl Friedrich Gauss, but no one knows how the dayan method developed. Also, Qin Jiushao solved a problem involving a 10th degree equation, but only siad to use "the gu-minus-gourates." Even today, no one knows the precise meaning of these words. Other major achievements of the Song-Yuan period are the tianyuanshu, a method for solving equations in one unknown, as well as formulas for summing higher order arithmetic progressions and series using the method of "small differences." Historians of mathematics must use scientific methods to

examine these incomplete surviving bits and pieces in classical Chinese mathematics to reconstruct the systematic development of its procedures and methods.

Contribution ID: 406

Approaching the "True Value" (Mihe 密合) and Cui Chaoqing's Examination of Two Pursuit Problems in the Nine Chapters: "Rushes and Reeds Growing Simultaneously" and "Two Rats Tunneling Through a Wall"

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The two problems of Puguan bingsheng 蒲莞並生 (Rushes and Reeds Growing Simultaneously) and Liangshu chuanyuan 兩鼠穿垣" (Two Rats Tunneling Through a Wall) refer to Problems 11 and 12 in Chapter 6 devoted to "Excess and Deficit" in the Jiuzhang suanshu 九章筭術 (Nine Chapters on the Art of Mathematics). Both are devoted to two kinds of so-called "pursuit" problems. Problem 11 concerns rushes (pu 蒲) and reeds (guan 莞), reeds growing faster than rushes at first, but day by day, the growth rate of the rushes halves while the reeds double. The problem is to find when the two will meet. Likewise, Problem 12 concerns two mice tunneling through a wall from opposite sides. Given the rates at which they are able to tunnel in a day, and the thickness of the wall, the problem is to determine how long it will take before they meet, and how much distance each will have covered. This presentation will examine the commentary of the late Qing dynasty mathematician and educator Cui Chaoqing 崔朝庆 (1860–1943) and his understanding of these two problems in particular, and how they relate to the study of movement and limits in the history of Chinese mathematics. Cui's work was entitled Yingnü yide 盈朒一得 (Some Notes Gained from Studying the Method of Excess and Deficit in the Nine Chapters), first published in 1898 and with a preface in 1896.

Contribution ID: 398

Survey of mathematics during the Warring States Period: from bamboo slips to ancient documents of the Qin and Han dynasties

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With research results on the history of Mohist School and classicals such as Mozu 墨子, a study on the recent unearthed bamboo slips of the Qin and Han Dynasties results in a relatively complete chain of evidences which indicates that the Jiuzhjang suanshu 九章筭術 (Nine Chapters on the Art of Mathematics) was a compilation of basic mathematics textbooks of Qin during the Warring States period, Mohist School was the main contributors to the formation of these mathematics textbooks, and that before the middle of the Warring States period, the Mohists had relied on deductive evidence to establish a relatively complete mathematical system roughly equivalent to the mathematical system of Euclid's Elements of Geometry.

Contribution ID: 408

On the Stylization of Traditional Chinese Mathematics

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The "stylization" of mathematics concerns its normalization in terms of recurring modes formed in the process of long-term use, transmission, and inheritance of a certain form. Stylization is a universal feature of Chinese culture. Examples may be found in Chinese painting, drama, architecture, medicine, and other cultural areas, all of which are subject to certain stylized themes or motifs. Chinese mathematics has also been subject to its own specific stylized features, and analysis of such books as Yanghui suanfa 楊輝算法 (Yang Hui's Methods of Computation) (1274–1275 CE) and Zhu Shijiei's Suanxue qingmeng 算學啟蒙 (Introduction to Mathematical Studies) (1299) reveals that stylization of Chinese traditional mathematics may be reflected in various ways. For example, most traditional Chinese mathematical works follow a standard structure, divisions into chapters, presenting problems in a standard problem-question-method-solution format, or in the way in which algorithms are presented following certain set patterns. This presentation will consider the effect that such formulaic aspects of standardizing mathematical works may have had on the progress of mathematics, including social and cultural factors that have contributed to the stylization of traditional Chinese mathematics.

Session X (Part 1/2) - Diplomacy, behavior

Contribution ID: 1190

'Pure and Applied Regulations': The origins and evolution of Portuguese science-based Food Safety legislation (1875-1905)

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The Portuguese First Public Health Act (1899-1901), was the ground-breaking piece of legislation that paved the way for the mass dissemination of food safety standards in Portugal. However, even before the State's initiative, the Porto Municipality urged throughout the 19th century for strict regulations on water and food quality, establishing scientific institutions for such supervision and investigation. This effort, a true model for Portuguese major cities, was brought by a surging academia of experimental chemists, named as "the Portuguese chemistry golden age". As scientists behind some innovative European protocols on food safety, this movement spun nation-wide awareness for food safety and its implications on public health and "purity and quality" of food trading goods.
Historians seldom studied the inception of these new Portuguese regulations. However, across European academies, it is well established the pivotal role of scientists and policy-makers on the emergence of modern public health issues. But, as reported, sometimes the motivations behind these movements do not always have an underlying health concern, being overcome by economical, cooperative or personal intents. Ultimately, its repercussions could conceive alternative interpretations of scientific standards, bent to support dubious goals.
This communication presents novel historical information to the urging contemporary debate on health and food safety. It tracks the evolution of Portuguese food safety legislation and early forms of inspection, even before the First Public Health Act. By presenting a revised timeline, we highlight

legislators' and chemists' motivations behind several interpretations that led to different concepts of public food health standards.

Contribution ID: 1157

Scientific policies in Brazil under democratic and authoritarian governments after Second World War

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Political systems in Brazil dramatically changed from 1945 on. There was a succession of democratic governments, until 1964, followed by a military dictatorship, until 1985, and again democratic governments since then. Overall, under these different political systems, science and technology was supported and much of Brazilian system of funding science was created at those times, namely the second half of 20th century. There were some ups and downs in this support but they cannot be directly related to the kind of political systems. We investigated thus what kind of factors allowed the continuity of such support through these different political systems. We work with the hypothesis that two different factors resonated reinforcing scientific institutions. First, the aspiration for the economic and social development, meaning modernization and industrialization, coalesced in a widely shared view called in Portuguese the "desenvolvimentismo", which means the quest for the development. Second, Brazilian military ambitions, both for peaceful and military uses. As the strength of these two factors receded in the end of the 20th century, support for science and technology entered into a stage of uncertainty strongly depending on the different governments and projects. In addition to this analysis we have also studied the impact on Brazilian sciences from the restrictions of civil liberties during the military dictatorship between 1964 and 1985. There are strong evidences of the hindrances created by those authoritarian times. We conclude bringing together these different contexts to exhibit the vicissitudes surrounding development of science in Brazil.

Contribution ID: 942

Anticipating Transformation: Emigrés as cross-bloc Expectation Managers in 1980s Europe

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Current research on the history of knowledge highlights the constructiveness of the increasingly important figure of the "expert".
Migrating, on the other hand, not only requires but also produces a certain knowledge or expertise. In my paper, I will therefore link the history of knowledge with the field of migration studies by adopting the latter's concept of "biographical capital" for analyzing the construction of the expert and the collective management of political expectations in 1980s Europe.

In doing so, I will focus on a network of Czechoslovak scientists exiled to Western Europe after 1968. This group notably comprised of former Prague Spring leaders such as Ota Šik (economist), Jiří Kosta

(economist), and Zdeněk Mlynář (political scientist), working in exile within German, Austrian and Swiss universities and research centers.
They served as "experts" in public and internal debates on Soviet-type Communism, in Germany especially within political parties and foundations.

Based on archival sources, my paper offers three perspectives:
1) It provides a cross-block approach on knowledge transfers from East to West and on the production of transnational knowledge that helped to overcome the "Cold War".
2) It introduces the concept of "biographical capital" in order to analyze the interplay of scientific status and migration experience regarding the construction of an expert image.
3) It interprets experts as managers of collective expectations by outlining their major impact on late 1980s ideas of future political change in (Eastern) Europe.

Symposium (Part 3/6) Transportation History: Railway modernisation - infrastructure and motive power (ICOHTEC) - ID 492

Contribution ID: 799
Reservation systems for passenger railway travel

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Reservation systems form a backbone of business for any travel industry, including railways. Without well-functioning reservation systems, modern railway traffic would be in big trouble.
Airline travel reservation systems have collected a lot of attention from Information Systems (IS) Scholars. Airline reservation systems have actually been seen as key electronic commerce and digitalization developments in the whole society, at least in the early days of computerization. For some reason the railway passenger traffic systems have not got the same kind and amount of attention. One main reason might be that railway reservation systems are national, airline reservation systems global. Issues of openness and disclosure of technical documentation, as well as language barriers, might also contribute to the lack of material on railway passenger reservation systems.
This article analyzes the scientific discussion on railway passenger reservation systems, based on a systematic literature review. Pre-study has found out that there is a lot of prototype building on different mobile and other applications for passengers to reserve railway services. Our literature study will focus on literature focusing on industrial-scale systems that have been on continuous real use for long time. The reference science for the study is information systems, and if material is plenty, focus will just be on information system design and management properties of the systems.

Session III (Part 3/3) - Geography
Contribution ID: 1240
Wahlenberg's forgotten map: barometer, vegetation and colour layer tinting

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A Swedish botanist, physician, and natural historian arrived in the Kingdom of Hungary in 1813. As an ambitious demonstrator of Uppsala University, Göran Wahlenberg (1750-1851) conducted botanical-geographical explorations in the Carpathians. He summarized the results of his four-months long fieldwork in the book *Flora Carpatorum* (Göttingen, 1814), which described the special flora of a less known region in East-Central Europe. Although an account on botany, the work included a treatise on the altitude, vegetation, temperature and general geography of the mountains, and an account on barometric measurement. Wahlenberg also attached a '*physical* map, which was the *first* cartographic representation in the world with color layer tinting. In this paper, after presenting and inspecting Wahlenberg's unique map as a plant geographical and a hypsometric representation, we try to reconstruct the diffusion of the representation in the two related fields, plant geography and cartography. Although a contemporary of Humboldt and an acknowledged botanist, after Wahlenberg's death his work became relatively quickly forgotten and rarely used as a primary source in the second half of the 19th century. On the other hand, taken out of the botanical context, the map was interpreted as a pioneering achievement of *relief representation* by later mapmakers of the High Tatras. In this paper, we reconsider the cartographic processes resulting in the methodical importance and reinterpretation of Wahlenberg's map in the evolving paradigm of relief representation on topographic maps.

Contribution ID: 1207

Alfred Russel Wallace and the authority of field observation: the making of a giant of the ethnography of the Amazon

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This paper discusses Alfred Russel Wallace's quest for scientific recognition for his ethnographic explorations of the Brazilian Amazon (1848 – 1852). Even as a collector of species with a modest formal education, Wallace had not limited himself to profit from the sales of duplicates in the species market. In addition to his developing investigations of biogeographical distribution and species change, one of his main objectives for exploring the Brazilian Amazon was to return home as an authority on the ethnography of the Amazonian Indigenous peoples. The scientific reception to Wallace's ethnographic observations took place in the context of the early disciplinary formation of Ethnology in Britain. In the mid-1800s, the leading practitioners of the field were keen to attract travellers with potential to produce more refined ethnographic reports of extra-European people. They were especially interested in travellers with high specialised professional training, such as in Medicine. However, because of the expansion of print, it soon became evident that almost everyone with access to questionnaires, manuals, pamphlets, and ethnological compendia could be a potential observer and collector of ethnographic data. Having an autodidactic but rich knowledge of the main ethnological subjects and naturalistic observational techniques, Wallace was the kind of qualified field-worker highly desired by British ethnologists. In addition, the incipient state of British ethnological studies of the Amazon added extra value to Wallace's ethnography. Indeed, he saw this state of things as an opportunity to gain recognition for his firsthand observations of supposedly "uncivilized" and hardly accessible Indigenous groups.

Contribution ID: 1277

Scholars who travelled and explorers we remember. Perspectives on the character and crew of the Nordenskiöld expeditions in the 1860's and 1870's

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This paper studies practicalities and personal interests involved in nineteenth-century natural expeditions and how participants negotiated themselves a recognized place as expedition members. The examples concern the Swedish expeditions to the Arctic in the 1860's and 1870's and concentrate on scholars who joined in from the neighbouring Grand-Duchy of Finland, the native country of the expedition leader A. E. Nordenskiöld (1832-1901). Through private correspondences of these partisipants this paper explores their individual ambitions and actual contributions, how authority over the results was negotiated between participants, and what kind of other contemporary discourses influenced their recognition. The paper is inspired by recent scholarship highlighting different invisible or negliged actors in the process knowledge creation yet focuses mostly on the colleagial relations between scholars. It studies the everyday aspects of the expeditions as opposed to their public presentation, and compares the nineteenth-century narratives and ideals of exploration to later historiography.

Symposium (Part 2/3) CHCMS (History of Chemistry and Molecular Sciences) - ID 934

Contribution ID: 1302

Tacit Conventions and the Making of the Modern Chemical Notation: How Editors, Publishers, and Printers of Scientific Journals Shaped Structural Formulae in the 1870s and 1880s

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Structural formulae function not only as heuristic tools in research and education, but also as a means for communicating and debating chemical knowledge outside the laboratory. Yet the gradual development of the formulae's distinct visual appearance is still poorly understood. Why do these line-and-letter formulae look the way they do? And how did the diagrams become the standard notation of organic chemistry? Aiming to provide a detailed account of the iconographic evolution of the modern chemical notation, I argue that the processes which led toward a standardised appearance of the formulae were not driven by official agreements between members of the scientific community, but rather by market forces governing the production and distribution of scientific print.
I combine perspectives from history of chemistry with history of science communication to explain these processes by illustrating how the rise in research activity in organic chemistry from the 1860s onwards resulted in a significant increase in the number of articles published in German scientific periodicals. The growing amount of space taken up by the new formulae obliged editors and publishers of abstract

journals to introduce editorial measures for fitting more abstracts on the page of their journals in order to secure their journals' commercial success. Taken together, the editorial measures introduced by leading German and British abstract journals finally resulted in a noticeable reduction of the iconographic variety of the formulae and thereby contributed to a more uniform appearance of the new notation on the printed page.

Contribution ID: 1303

Color and oxidation: Nonstandard tools in efforts to determine structure and size of aniline polymers in the early 20th century

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The beginning of the 20th century was a turning point in polymer science, with the macromolecular theory of Hermann Staudinger (1881-1965) at odds with the more commonly accepted colloid phenomena. During this point, much effort was focused on the characterization of polymeric materials with a focus on explaining the high molecular weights determined via the osmotic pressure and freezing point depression of polymer solutions. During this same time period, Richard Willstätter (1872-1942) and Arthur G. Green (1864-1941) were independently studying the deeply colored materials known as aniline black (modern polyaniline). However, due to the limited solubility of these materials, they could not be studied using conventional methods of the time and thus the focus of both groups was the use of color changes in an effort to determine structure and size. Although the two were often at odds, the combined work of Willstätter and Green ultimately produced complete structural models, including those of the full series of known polyaniline oxidation states. While the sizes of the polymeric materials were significantly underestimated, the chemical models determined still remain the currently accepted structures of these polymeric species. A detailed account of these efforts over the period of 1906-1912 will be reported, with an emphasis on the conflicting reports between these two groups.

Contribution ID: 1304

Patenting Agent Orange: Chemical Classification, Novelty, and the Military-Industrial Complex in the Cold War United States

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Following the Second World War, U.S. chemical companies filed a series of patent lawsuits concerning a new class of chemical herbicides, the chlorinated phenoxyacetic acids. The outcome of these suits contributed to the global growth of the agro-chemical industry and facilitated later military use of these compounds as defoliants, first by the British during the Malay wars of decolonization, and second by the Americans in the Vietnam War. In order to produce these herbicides, Dow Chemical and Sherwin-Williams filed two separate suits to declare the American Chemical Paint Company's 1945 patent invalid. American Chemical's broad claims did not stand up to court scrutiny, and the company reached unfavorable settlements in 1947. By examining these suits, I show that narrow standards for intellectual property allowed for wider production of chemical defoliants and thus undergirded Cold War military operations. Moreover, these suits offer a lens into the intellectual history of chemistry. As they argued

for the legitimacy or illegitimacy of herbicide patents, lawyers necessarily made claims about chemical classification, the possibility of claiming 'facts of nature,' and what constitutes an 'inventive step' in chemistry vis-à-vis engineering. Given the legacy of wartime secrecy, they also argued whether secret knowledge counts as 'obvious' knowledge in patent law. What images of chemical invention governed these postwar intellectual property disputes, and what was their impact on chemical work and chemical warfare?

Contribution ID: 1305

From parasitic to indispensable: synchrotron radiation sources in biological research

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Synchrotron radiation applications´ research started its existence as a parasitic activity on the side of the more highly esteemed high energy physics. Although already from the 1920s physicists were investigating the possible use of magnetic-induction electron accelerators for the production of intense x-ray beams (betatrons), and despite the fact that synchrotron radiation was a predicted phenomenon already from the 1940s, the applications were slow to be recognized and materialized. This paper is offering an overview of the early steps of dedicated synchrotron installations and the introduction of these machines in researches in biology during the last decades. Starting from the concept of the *big science for small science*, the paper attempts to build a working epistemological analogy between philosophy of instrumentation and thing knowledge in chemistry, and big science installations and laboratories in today´s biochemistry and genetics. The specific case of the most modern application of synchrotron installations in non-viral gene therapies is being used to demonstrate and strengthen this analogy.

Symposium Empire of knowledge: South Asia, 1850-1971 (Science and Empire Commission) - ID 502

Contribution ID: 611

Western Sanitary Science and Hygienic Practices in South India, 1850-1920

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Western sanitation and hygienic practices during the nineteenth century in India intended to safeguard of white bodies from diseases like cholera, malaria and smallpox, posed as a serious threat to their physical existence. Accordingly, different health and sanitary remedial schemes implemented for the protection of military cantonments, barracks, ship journey, port towns and cities. In this process, physicians, surgeons, medical board sanitary officers engaged with sanitary science and formalized and circulated in the colony. This produced discourses on climate, native people, 'dirt', waste, locality, drainage, water supply, habits of British troops - diet, drink, dress, duties, and so forth. All these became a testing ground for the scientificity and efficacy of western medical and sanitary science in

colonial India. The historical works so far on colonial public health and sanitation in India have understood as means of colonial control. There was complex reciprocity also involved in making of sanitary science, hygienic practice with an idea of improvement of the colony. Against this background, this paper tries to understand the contours of sanitation and hygiene by looking at the western and Indian dichotomies and also sketches how did Western sanitation and hygienic practices formulate particularly in South India.

Contribution ID: 590

Evolution of electrical engineering in colonial Calcutta: Bhadralok aspirations on academia and industry interface, 1880s – 1940s

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In the early 20th century Calcutta, the electrification of the city, its industrial application, and transportation narrative all stand out as the biggest engagement for the bureaucrats, engineers, nationalists, and ordinary Indians. The arrival of electricity necessitated the introduction of new institutional facilities. With the growth of the technological system, a supportive culture also grew – trained manpower to handle the machines, better educational facilities, new business culture, etc. The CESC, a London based power company, was instrumental in the generation and supply of electricity in Calcutta – both urban and industrial. From the beginning, they realized the need to create a pool of personnel (basically Indians) with elementary knowledge on electrical engineering. Thus, the Bengal Engineering College, Sibpur, started providing basic instruction on the subject. The erudite Indian elites identified, on several occasions, the imperfect training of Indian engineers, including electrical. A nationalist's initiative, College of Engineering and Technology, Jadavpur, from its inception, used to provide advanced training in electrical engineering. Investments in education, especially techno-scientific, were now seen to be of great importance. The electrical power was to be the key to a modern industrial economy excited Bengali *bhadralok*. Based on the archival materials, college documents (annual reports, calendars, curriculums, etc), and vernacular sources, this paper is basically on the education of electrical engineers as it had evolved and developed in the late years of the Raj, and the interface it had with entrepreneurship and industry in a colonial metropolis – Calcutta.

Contribution ID: 603

Changing geographies, redefining disease: migration and modernisation in ayurveda, 1902-1960

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The impact of the western science and medicine on Indian medical traditions under colonial and post-colonial contexts has been the concern of a variety of scholarly engagements. Yet, beyond the idea of therapeutic modernisation of non-european medical traditions, negotiated primarily through the epistemic premises of western medicine, colonialism both as a state system and as an ideological apparatus opened up a new possibilities of understanding as to what is meant by morbidity and cure, within indigenous medical traditions. The changing nature of colonialism generated the fear of the

subjugation and the loss of self under colonialism-a fear that found expression in the manner in which indians came to perceive of their bodies and ailments within colonial contexts. As Colonialism was also about the movement and exchange of goods and people, from both within and external to the subcontinent, also made people to conceive of their bodies to be drained of bodily essence or vital energy, the *Ojas*. Ayurveda Vaidyans (physicians) responded to such concerns by repositioning ideas of disease and cure in a language intelligible to the changing concerns of early twentieth century's cultural imagination. In the process of negotiation between the practitioner and the patient there emerged a new domain of Ayurveda that reordered drug formulations in accordance with the changing conceptions of the disease. By engaging with patient records, this paper seeks to explore the space of negotiation between the patient and the practitioner within Ayurveda.

Contribution ID: 586

Towards a new modern: The land grant model and India's rural universities

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The decade of 1960s saw the establishment of India's "rural universities" under a partnership with five Land Grant universities in the United States. The first university came up at Pantnagar during the Second Five Year Plan and six more at Ludhiana, Udaipur, Jabalpur, Hyderabad, Bangalore and Bhubaneshwar during the Third Five Year Plan. Looking back from 1971, C. Subramaniam, Indian minister who oversaw the consolidation of India's green revolution in the 1960s could not miss the role of these new universities in enabling the "breakthrough" in food production that the green revolution had come to symbolize. The two developments in the realms of technology and education were, Subramaniam argued, "intimately connected." K.C. Naik, the founding Vice Chancellor of the university in Bangalore, saw the new universities as representing a new modern. Naik claimed that India had to break away from the British system of universities and research institutions that it had inherited. The postcolonial nation had to actively and consciously imbibe the American land grant system for agricultural modernization. Naik called the change "a process of liberation" for India. The Radhakrishnan Commission of 1948 had first pointed out the need for rural universities. But the salience of Land Grant system dawned in the era of American aid regime in India in the 1950s and 60s. This regime ensured that the colonial modern became the new "traditional" and created the space for the new imaginaries of "modernization" at India's postcolonial moment.

Symposium (Part 1/3) Great to small: spatial and temporal scales in the history of the geosciences (INHIGEO) (with IUGS) - ID 504

Contribution ID: 941

Powers of Scaling: Conceptual and Sociopolitical Considerations in A. P. Coleman's Mapping of the Sudbury Region

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Cosmic Zoom, a film by Eva Szasz, depicts scaling as it moves from the human to global, solar and galactic levels, before zooming inward to cellular and eventually subatomic levels. Szasz's film is an inspired treatment of the multiple reiterations at work in scaling, as is Charles and Ray Eames's *Powers of Ten*; both films were adaptions of Kees Boeke's book, *Cosmic View: The Universe in 40 Jumps*. From massive technoscientific systems for studying subatomic particles, to microscopic mineralogical deformations used to explain geological features thousands of cubic kilometers in size created by impact events over a billion years old, which in turn are explained at an interplanetary scale, scaling is everywhere in the sciences, and large scale physical *and* temporal scaling have always been at the core of the geosciences. Scaling's ubiquity might blunt its usefulness as a tool for historical analysis, but by narrowing focus—in this paper on A. P. Coleman's geological map, the "Sudbury Nickel Region"—scaling affords insights into conceptual and sociopolitical problems of the geosciences. The Sudbury region is now understood as a massive impact structure; Coleman had a radically different explanation. Yet Coleman's 1912 map was hardly incommensurable with impact explanations, for it succeeded in identifying and making visible the Sudbury region as a single, unified geological feature. Coleman's map was also a part of sociopolitical scaling, for Sudbury nickel, exported to Britain, Germany, Italy and the US in the early twentieth century, was deeply entangled with national and imperial ambitions and conflicts.

Contribution ID: 758

From rocks to mountains: the use of 'small' specimens for the 'great' history of the Earth during the 18th century

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The aim of this paper is to investigate the extent of the transition from the concept of studying 'small' specimens - during fieldwork and/or within specialized lithological, paleontological and mineralogical 'working' collections - to the production of theoretical models based on large chronological and geographical scales, in order to explain 'great' phenomena such as mountain building and other major changes of the Earth's surface.
During the eighteenth century, the growing community of Earth scientists (called oryctologists in several parts of Europe) gradually acquired the characteristics of an autonomous scientific practice, which empahsized the primary role of detailed research on geological features in limited areas, as well as the comparative study of numerous small sized specimens, before to attempt any theoretical interpetation. Their works will provide some examples in order to show this methodological inductive attitude 'from small to great' in a particular field of the history of the geosciences.

Contribution ID: 949

Macro-evolution vs micro-evolution in Palaeontology. The 1970's "Punctuated Equilibria revolution" and its scientific/political issues

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In 1972, a paper by Niles Eldredge and Stephen Jay Gould entitled "Punctuated equilibria: an alternative to phyletic gradualism", announced a major revision in the Theory of Evolution and in the vision of life evolutionary processes. This very influential paper, and following publications by its , put forward the necessity to consider the alternation of sudden speciation events and long continuous stases in the process of *macro-evolution,* and thus to break with the sole focus on *micro-evolutionary* processes, which had followed the introduction of genetics and molecular biology in the biological sciences by the previous generation of the Neo-Darwinian Synthesis. Thus, its urged to give again to geology and palaeontology, that is to the dimension of *time*, a central place in the study of life history and its processes. By this attempt to reintroduce the notion of discontinuities and "revolutions" in the history of life, they also claimed for the necessity to break with the ideology of progress implied in Darwin's gradualism.
In this paper, I will study and evaluate the different scientific implications of this epistemological shift from micro- to macro-evolution, and its impact on biological, palaeontological and geological research which developed through the following decades. I will try to enlighten the philosophical, sociological and political background of what was then given as a scientific "revolution".

Contribution ID: 667
Scaling down the earth's history: visual materials for popular education by Nerée Boubée (1806-1862).

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Spatial and temporal scales are essential constitutive parts of geological sciences. Both are almost always imbricated in complex ways, challenging the understanding of geoscientific knowledge by non-specialists and students. The present paper will focus on the efforts made by the French naturalist Simon-Suzanne Nerée Boubée (1806-1862) regarding popular education on geology. Boubée was an active person, and even though he is poorly known nowadays (a "dwarf" in the history of science?), he experienced some prestige during his lifetime. He worked as an independent teacher, offering private as well as free public courses. Boubée's profile fits well into 19th-century science popularizers, and he repeatedly insisted on his disposition to "spreading science for all." He extensively published books and journals on geology, all aimed at popularizing that scientific knowledge, considered to be of paramount relevance. This paper will analyze three visual examples extracted from his books, namely: "Tableau Mnémonique des Terrains Primitifs, destiné au géologue voyageur" (1831), "Tableau de l'État du Globe à ses différents âges" (1832), and "Tableau figuratif de la structure minérale du globe, ou résumé synoptique du Cours de géognosie de M. N. Boubée" (1839). It aims at understanding the synthesis efforts undertaken by Boubée through scaling down geologic time and space in foldable materials, to make geological knowledge, cognitively and materially, accessible to non-specialists.

Symposium (Part 3/5) Re-scaling & de-centering the history of oceanography: the 'hidden figures' and hidden dimensions of global ocean science (ICHO) - ID 450

Contribution ID: 591

"Unnamed marine animals" – oceanic microfauna, collection ecologies and hidden knowledge makers, ca. 1750-1850

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In Tupaia's famous painting of Joseph Banks a marine animal takes centre stage. Inspired by this bright red lobster, this presentation will analyse encounters with often neglected animals in the history of global ocean science. In 18th century taxonomy both crustaceans and molluscs fell under the rubric of insect, thus encounters with these animals as food and as objects of scientific interest are manifold. By choosing to focus on actual, literary and visual encounters with the blue sea slug (glaucus atlanticus), this presentation will show how a micro-historical reconstruction of the processes of human knowledge formation on a specific animal can reveal much broader aspects of the marine histories of science and technology, namely international exchange that also included landlocked nations as well as the diversity of human and non-human actors in these processes.
The network of European scholars writing on marine microfauna also relied heavily on information and collaboration with non-academically trained knowledge makers, like Tupaia or other sailors and navigators or the many (often female) artists who helped to circulate this knowledge. This microhistory promises to re-scale and de-centre the history of oceanography in acknowledging the intellectual labour of hitherto neglected humans as well as the importance of microfauna for historical ecology. Consequently, I will argue that bringing environmental history in conversation with the history of collecting can provide new perspectives on the business of collecting during the so-called "voyages of explorations."

Contribution ID: 835

Science from the quarterdeck: Naval-scientific networks and the 1870s Challenger Expedition

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A partnership between navies and scientists was key to the development of a science of the oceans, from early efforts to map global tidal forces to Cold War efforts to understand underwater acoustic phenomena. In each case, the needs of ocean scientists for patronage and access to large technological platforms aligned with governmental needs to make knowledge claims about the ocean bottom for imperial as well as commercial reasons. But focusing on organizational relationships, while important, elides the human relationships between the naval personnel and scientists who actually shared the decks of ships.

This paper considers the role of individual naval officers and their networks in the planning and conduct of the British Challenger Expedition in the 1870s. Naval officers and networks proved crucial to the origination and success of the project at every phase, from its origin in London meeting rooms to its conduct on the ship's quarterdeck to the publication of its results. Far from simply lending assistance in the form of ships and men, individual officers influenced the hands-on conduct of science and its popularization back home. And far from simply performing a duty, some also leveraged their

participation to personal benefit in naval, political, and scientific circles. All told, the partnership allowed each side access not just to equipment and data, but also to new networks and new forms of recognition even as these individual ties helped solidify the organizational partnership for the longer term.

Contribution ID: 797

"So-called" coral reefs: Algae, transnational networks and the biological turn in reef science 1896-1928

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In 1942, the Dutch botanical journal Blumea published a special issue dedicated to celebrating the career of Dutch algologist Anna Weber-van Bosse (1852-1942), who was best known for her work classifying marine algae from Southeast Asia. The introduction noted her many international scientific correspondents, among whom were her "dearest friends" the American algologist William A. Setchell (1864-1943) and British algologist Ethel Barton Gepp (1863-1922). Networks of correspondence were common among naturalists in this period, and the algological focus on classification and geographic distribution encouraged transnational correspondence among scientists sharing specimens. But these three algologists, who shared an interest in the role of macroalgae on reefs, formed a network which operated differently than most naturalist networks: their network was independent from institutional oversight, lacked a formal hierarchy and its members shared information laterally. At the same time, these three algologists were embedded in imperial networks which gave them access to large and well-funded expeditions like the Dutch Siboga expedition (1899-1900) and the British-Australian Coral Reef Drilling Expeditions (1896, 1897, 1898). This paper traces the collision of multiple networks to show how knowledge about plant life on coral reefs was produced and circulated. It argues that because the main actors and their objects of study were peripheral to the geological debates which dominated coral reef science in the late nineteenth and early twentieth centuries, they were able to shift the scientific discourse of reefs from being primarily geological to being primarily biological.

Contribution ID: 908

Circulating coral: Tracing the Pacific origins of captive coral systems

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In 1961, Lee Chin Eng, a Chinese man living in Indonesia, wrote an article in an American magazine describing his method for keeping captive coral. Eng outlined a process developed by at least three other men working in Indonesian coral husbandry at the time and his accompanying photographs contained images of an active community of divers. At the time, other hobbyists were experimenting with coral tanks in Hawaii, New Zealand, and North Africa. However, in a matter of decades, the coral reef hobby became centered in North America and Northern Europe. Today, those same coral

techniques developed in Indonesia are being "introduced" to Indonesians by Western conservation groups hoping to save coral systems from destruction.
This paper traces the circular path of corals and coral knowledge, from Indonesia in 1961 and back again today. Ann Elias has written on the development of coral reef imagery in the West. In her work, coral became an object of high art and curiosity for the West and a blank space upon which to write colonial narratives about both the ocean and the people who live and work near it. This paper will extend Elias' work to ask how Pacific knowledge about coral was both trusted because it came from Pacific people and also decoupled from its origins to allow Westerners to construct imagined reefs. Understanding how non-white actors can be both knowledge producers and understood as having no access to marine knowledge demonstrates the complicated politics of the marine world.

Session XI Computers

Contribution ID: 1235

The birth of a metaphor: the golden age of 'artificial intelligence' research 1956-1976

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The field of artificial intelligence is built on what Richard Boyd calls a "theory-constitutive metaphor," one that equates computational power with human cognition. The term was first used in 1955 as part of a funding application for the 'Dartmouth Summer Research Project on Artificial Intelligence' by computer scientist John McCarthy. The event can be understood as a type of naming ceremony, one that embraced a structural metaphor that has come to influence research conducted in AI labs and how it shapes the very questions that are asked.
This paper traces the metaphors used in artificial intelligence through an assembled corpus of scientific papers from 1956 to 1976. I use tools from linguistic anthropology, namely corpus analysis and Critical Metaphor Analysis.
The structural metaphor underlying the term 'artificial intelligence' is that the COMPUTER IS A BRAIN. Other metaphors appear in the scientific literature of the time to try and explain the phenomenon of complex computing in non-cognitive terms. Theorists described the inner workings of computers as everything from telegraph wires connecting buildings on a Western-front homestead, to the process of climbing a hill shrouded in fog, or to a growing tree producing decision options with each new bud of growth.
The philosopher Max Black wrote that "perhaps every science must start with metaphor and end with algebra," (1962, 242); the goal with this present study is to trace this transformation, from metaphor to algebra, through corpus analysis.

Contribution ID: 1066

The indispensable modern – the advertisements of computing technologies and their representations during redemocratization process in Brazil (1977-1985)

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Since the 1970s, Brazil has become one of the largest consumer markets for computers and data processing services in developing countries. This motivated the State to establish a national Informatics policy in 1976, forging a native industry in the 1980s, in order to bring the country closer to technologically developed nations. These transformations reached society through the written press, often mediated by advertising pieces, which aimed to promote and offer technological products. When we take into account that the consumption dimension is an important factor to understand how technologies can be appropriated by society, the role of advertising is important because it not only conveys technical or economic differentials of Computer products, but presents social and cultural values that encourage their acquisitions. Thus, our research aims to understand how technological artifacts were represented through Brazilian print advertising, published in newspapers of great circulation and publications specialized in Informatics between the 1970s and 1980s. Research has shown the presence of representations linked to nationalism, the modernization of society and the autonomy of individuals, since computers were presented as vehicles for the country's development, efficiency in the business world or intellectual development of microcomputer users. Analyzing how advertising dialogued with the context of redemocratization in the country at the end of the Military Dictatorship and technological control makes it possible to understand how these values alternated between a more technocratic view of the State on the lives of citizens and another view that emphasized autonomy experiences of individuals.

Contribution ID: 1162

Female computers and more at the International Latitude Observatory of Mizusawa

Yukie Baba
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In 2015, Yukie Baba and Toshiaki Ishikawa found more than 500 glass plates covered with dust and mold on the Mizusawa Campus, the National Astronomical Observatory of Japan. Digitizing the glass plates revealed a history that local women had worked at the International Latitude Observatory of Mizusawa since the 1920s as human computers and more.

In 1899, the International Latitude Observatory of Mizusawa was founded as one of the six observatories for the International Latitude Service (ILS), whose mission was to discover the precise movement and cycle of the polar motion of the Earth. In 1922, the observatory became the Central Bureau of the ILS, meaning that it is now their responsibility to calculate all the data from the ILS observatories. Although only three observatories of Mizusawa, Carloforte, and Ukiah remained working due to WWI and natural disasters, calculating a massive amount of data was still a considerable burden for the Central Bureau with a tight budget.

Hisashi Kimura, the Central Bureau director, found the solution and began to use a cheap workforce, namely the young local women who had just finished high school. In those days in Japan, women could not go to university unless they were wealthy and privileged. Thus, working for an international science project was a dream job for the young women of Mizusawa. They worked there as human computers, typists, clerks, editors, or research assistants. Hiring young local women became a tradition at the Mizusawa observatory until personal computers replaced them in the 1980s.

Contribution ID: 1192

Writing the history of Artificial Intelligence from a peripheral/southern context: The experience from a non-anglophone European country

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The history of Artificial Intelligence (AI) is written, almost exclusively, from the perspective of national and international actors that come from the Global North. We introduce to our efforts at writing the history of AI from a comparatively southern/peripheral perspective. We take as our example Greece. Being a country of the West, yet, a non-anglophone one, Greece, is especially appropriate for such comparison. The paper covers AI-related artifacts and discourses about them in Greece, AI-related initiatives and institutions, covering about six decades (1960-2020). The primary material comes from published Greek sources, from scientific/technical journals to home science/technology magazines and newspaper columns on science/technology. As we argue, this comparison strongly challenges the canonical emphasis of the history of AI on ingenious scientists and engineers and their exotic plans for construction of idiosyncratic AI computers at a few prestigious institutional environments of the Global North. Instead of assuming that their relative scarcity in Greece means that there can be no history of AI in this country, we argue in favor of a broader definition of AI, one covering, also, humble but accessible computing technology, from commercially available mainframe computers to massively produced personal ones. And, further, a definition covering computing components integrated to standard technology, from work equipment and devices to family appliances. Based on this definition, our paper concludes by inviting attention to the history of attributing intelligence to artifacts like standard computers and computing components, which were much easier to find in a country like Greece.

Symposium (Part 2/5) Computing in the sciences and in technology. An Aristotelian perspective (HaPoC) - ID 12

Contribution ID: 83

Diagrams vs equations in circuit design

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Traditionally, the design of relay switching elements was through specification of the function of a circuit (causa finalis) and its gradual implementation through the combination of known and standardized circuits that served as building blocks (causa efficiens). The process of design (causa formalis) was mostly done through block diagrams on the engineer's drawing board. In the 1940s Boolean logic had been added to the engineer's toolbox, making parts of the design process amenable to algebraic and computational manipulation.
When the building of digital computers switched to semiconductor technology in the 1950s, the engineering practices, originally developed for relay and tube switching, had to be rethought. The change of materiality (causa materialis) had at least two consequences: The scalability of semiconductors made more complex designs possible; and the underlying physics was much more

complicated than before. Circuit designers had to find a compromise between clearly describing the operational structure of a computer on the one hand, and covering up the details of the underlying semiconductor physics on the other hand. During the 1950s a debate followed on the best strategy, one group of designers using block diagrams to design circuits, and others favouring Boolean equations for design. The eventual (partial) automation of circuit design enforced the equational approach.

Contribution ID: 252

There is no hardware either: virtual machines and practical languages

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The hardware/software dichotomy characterizes much thinking about computers. The two are thought to be somewhat independent. Theoretical computer science and much philosophy of computer science proceed without consideration of practical machines. Conversely, recent historiographical interest in materiality has downplayed the influence of abstract thought and structures. Software is generally seen as concealing, for good or ill, the more fundamental properties of hardware.
This paper examines the development of these ideas through the lens of work on (textual) programming notations in the 1950s. Research into computer programming in that decade was oriented towards a linguistic conception, but programming languages were not conceived of as artefacts and objects of study in their own right: this was a development of the 1960s, largely under the influence of the Algol project.
Rather, languages were designed for practical utility and had to triangulate between the expressive needs of programmers in a wide range of areas – including scientific and business computation, real-time applications, embryonic AI, and the machine processing of languages – and the limitations imposed by existing hardware and limited experience with language processing systems.
This complex situation allows us to reconsider the simple picture of programs as the causal agents that enliven otherwise inert hardware, an idea persuasive enough to have served as a model of the interaction between mind and body. We describe a more complex siutation in which the intentions of users and programmers and the properties of hardware combine in an account of program execution which decentres software.

Contribution ID: 264

There will be a time-fight tomorrow: Old problems in new logics

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Consideration of temporal properties of logic and philosophy has an ancient history, stretching as far back as Aristotle's future contingents and Diodorus Cronus' master argument. Debate on this topic continued through the scholastic period, but saw detailed and thorough treatment by A. N. Prior, who developed 'tense logic' in which notions of time and contingency are expressed as modalities. Although Prior saw an immediate application to computing, the ideas broke into this field only in the 1970s, and via alternate means.

In the late 1960s Manna was working on systems for proving termination of programs; Burstall made the connection to modal and temporal operators. Pnueli took Burstall's ideas and applied them to concurrent programming, naming this 'The temporal logic of programs'.

The case of temporal logic demonstrates an example of ancient ideas, once considered purely philosophical, ending up with serious practical applications. One interesting facet of this is the rediscovery of many old problems. Computer scientists working with temporal logic came against and argued about issues such as whether time should be considered branching or linear; the interpretation of future tensed propositions in the present; and the creation of appropriate models for logical systems. In most cases, these computer scientists considered these problems entirely unaware of the history behind them.

This talk explores the 'logic' background of temporal logic and investigates how the ideas came into computing. It considers the early field of temporal logic and shows examples of old arguments recurring in new contexts.

Symposium (Part 4/4) Placing mathematical knowledge in a world of and beyond nations (IASCUD) - ID 457

Contribution ID: 885

Cold War story-telling in the mathematical communities of the United States and the Soviet Union

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Whether transmitted in written or oral form, stories such as mathematical anecdotes are typically dismissed as reliable sources of professional historical knowledge, yet their power, popularity and proliferation make them too significant to be ignored. This paper offers one analytically sound approach to understanding the historical role and meaning of such tales. It explores the tradition of mathematical story-telling as a means of mathematical community creation, maintenance and expansion, and sometimes also as a means of communicating with the non-mathematical world. The early Cold War was a watershed in the mathematical community and in its relations with the non-mathematical world. In both the United States and the Soviet Union, mathematicians had during WW II had proven the value of their skill to science, technology and national security, contributing significantly to victory for the Allies. This wartime success had followed a period of threat to the global mathematical community prior to WW II. Early Cold War mathematical community story-telling in both countries reflected both fear of returning to the pre-War status quo, and efforts to maintain and advance the mathematical community power and success achieved in WW II. The political and economic systems of each country helped to determine the ways in which mathematical story-telling in the Soviet Union and the United States both reflected and was a reaction to this watershed moment.

Contribution ID: 848

Global mathematics and local masculinities

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Conceptions of mathematics around the turn of the twentieth century combined both mental and physical masculinities. While Cambridge Wranglers linked mathematical physics and problem solving with physical activities like rowing, American mathematicians linked the pursuit of abstract research with rugged individualism and nostalgic ideals of farm work. This talk considers the gendering of mathematics in the United States through specific cultural circumstances, including the closing of the frontier, industrial capitalism, and widespread urbanization, as well as through broader images and practices elsewhere. As historians like Mary Terrall, Lorraine Daston, and Andrew Warwick have shown, the gendering of mathematics has been achieved in different ways through its various forms. The adoption of modern, abstract, seemingly "foreign" forms of research in the United States required different forms of gendering than mathematics learned through the military or other applied fields. In general, the continual realignment of mathematics and masculinities has occurred through local practices and cultures, which may or may not always travel and translate. And yet somehow the association between mathematics and male bodies appears universal. This talk asks after the opportunities and challenges to exploring the historical gendering of mathematics that is at once local and global.

Contribution ID: 822

Toward a history of math anxiety: From oral examination to written testing in American redefinitions of student performance, 1890s-1920s

Andrew Fiss
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Arguing for a pre-history of "math anxiety" (before the coining of the term), the presentation draws attention to the transnational history of mathematics education, especially tied to the United States. Paying attention to the work of educational researchers of the early twentieth century, it analyzes the broad shifts from public oral examination to written testing, and argues for the ways that modified testing schemes literally redefined performance in classrooms in the United States and beyond.

Against the backdrop of grounding overviews of "standardized tests" as material tools of mathematics pedagogy, the presentation mainly focuses on the work of newly minted educational researchers surrounding Columbia University's Teachers College in the 1890s-1920s. Mathematics did have a special role in popularizing written testing. From the 1860s, American teachers had praised the quantifiable dimensions of standardized written testing, how it could reach large numbers of students with greater uniformity, greater accuracy, and greater effects than the previous model of public examinations (oral exams before large groups of observers from schools and beyond). From oral to written testing, these changes created new expectations for communication in mathematics classrooms, with unanalyzed effects. Emphasizing the quantitative study of students, educational researchers pushed new, explicit definitions of "student performance" -- linking notions of quantification, studenthood, written testing, and performance that anticipated and created late-century notions of "mathematics anxiety."

Contribution ID: 897
End-of-symposium comment and discussion, moderated by the symposium organizers

Michael Barany, **Ellen Abrams**
Science Technology and Innovation Studies, University of Edinburgh, Edinburgh, United Kingdom

The symposium organizers will moderate a discussion among presenters and attendees of the "Placing mathematical knowledge in a world of and beyond nations" symposium, focusing on common themes, historiographical interventions, and directions for future research and collaboration.

Symposium (Part 6/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 210

Contribution ID: 520
Back into the laboratory from 19th century toystores – the curious case of the Zeiss stereotelemeter

Andreas Junk
Physics, its Teaching Methods and its History, Europa-Universität Flensburg, Flensburg, Germany

In this talk I will analyse the construction history of the stereoscopic rangefinder, with a particular focus on the sixty-year period between the demonstration of its principle by Charles Wheatstone in 1839 and the construction of a measuring instrument by the German company Carl Zeiss in Jena.
The stereoscopic rangefinder is an observational instrument which uses the live view of a landscape to measure the distance between objects and the observer's position. The instrument, constructed as a double telescope, makes use of the parallactic shift between the respective images of the left and right eye. I will focus on two aspects which are crucial to the measurement process: the "hovering mark", which indicates the actual distance depending on the actual image plane of the telescopes, and the user's ability to see stereoscopic images.
With the rise of photographic methods and maybe more important advances in the newly founded field of stereophotogrammetry new measurement processes were invented. The two most important were the above named "hovering mark" and the "moving mark". Carl Pulfrich, section leader at Carl Zeiss company in Jena, completed an idea presented by the engineer Hector de Grousilliers to his company and turned it into an instrument by the end of the century.

Contribution ID: 371
The Turkification of Astronomical Instrumentation in Ottomans between the 15th and 19th centuries

Merve Sandallı

History and Philosophy of Science, University of Istanbul Medeniyet, Istanbul, Turkey

The reception of astronomical knowledge in Ottomans began in the 15th century. This was immediately followed by translations of Arabic and Persian astronomical texts into Turkish. It seems that the treatises on astronomical instruments were given priority in this process. This was because the wide range use of these instruments in religious practices such as five daily prayers. Astronomical knowledge was not just translated but also adapted to the Ottoman culture and thought, therefore the process evolved into a much complex concept: the Turkification of astronomy in the Islamic world. Two astronomers, Muhammad ibn Katib Sinan al-Qunawi al-Muwaqqit (d. 1524 circa) and Muslih al-Din Mustafa ibn Ali al-Qustantini al-Rumi al-Hanafi al-Muwaqqit (d. 1571), who worked as timekeepers in Istanbul, were the pioneers of this process. They compiled almost all their treatises in Turkish. Muhammad Qunawi's *Hadiyyat al-Muluk* on the construction of astrolabe quadrant and Mustafa ibn al-Muwaqqit's two works, *Kifayat al-waqt li-marifat al-dair wa-fadlihi wa-l-samt* on the use of astrolabe quadrant and *Tashil al-miqat* on the use of sine quadrant, were the three most popular treatises in the Ottoman astronomical corpus. Each of these treatises survived in around 100 copies which were compiled between the 16th and 19th centuries. The aim of this paper is to give a brief description of the Turkification process using these treatises as influential sources in the Ottoman astronomy and discuss the roles of Muhammad Qunawi and Mustafa ibn al-Muwaqqit in the characterisation of Ottoman instrumentation between the 15th and 19th centuries.

Contribution ID: 536

Evolution of astrolabes from planispheric to universal and its transmission from the Islamic west to Islamic east

Saliha Bütün
History of Science, Fatih Sultan Mehmet Vakıf University, XL Symposium of the Scientific Instrument Commission - Part 8/15, İstanbul, Turkey

One of the most significant indicators of the improvements in practical astronomy in the Islamic world between the ninth and fifteenth centuries is the diversity of instruments for observation and calculation. Several astronomical instruments were designed and developed such as armillary spheres, quadrants, and astrolabes. In this regard, Abū Isḥāq Ibrāhīm ibn Yaḥyā al-Naqqāsh al-Tujībī al-Zarqālī (d. 1100), a prominent astronomer of the eleventh century in al-Andalus, contributed to the instrumentation by inventing two instruments: *zarqāliyya*, which carries his own name, and its simplified version *shakkāziyya*. Both instruments are universal plates, a type of astrolabes. Referred as *saphea Azarchelis* or briefly *saphea* (*al-safīḥa*) in Latin, this instrument was almost exclusive to al-Andalus and Maghreb and had no equivalent example in the Islamic East. However, the concept of the universal plate was introduced to the region by Abū ʿAlī al-Ḥasan al-Marrākushī, a late thirteenth century astronomer who worked in Cairo, in *Jāmiʿ al-mabādī wa-l-ghāyāt fī ʿilm al-mīqāt* (*From A to Z: a Compendium of Timekeeping*). The treatise consists highly revised versions of manuals for construction and use of dozens of instruments. This article aims to introduce *zarqāliyya* from Marrākushī's perspective and discuss its impact on the astronomy in the Islamic East.

Contribution ID: 930

Jagiellonian University mechanicians –their workshop and instruments – 19th-20th century

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While the Jagiellonian University employed technicians from the late eighteenth century, this role grew in significance from the mid-nineteenth century when technicians were appointed and assigned to particular faculties of the University. Their tasks included taking care of scientific equipment, preparing experiments to accompany lectures, and helping to carry out research work. Technicians at the Faculty of Chemistry of the Jagiellonian University played a special role. Under the guidance of professor of chemistry Karol Olszewski (1846-1915), they made gas liquefying instruments used by Olszewski and also sold to other scientific institutions.
Using photographs of the mechanical and cryogenic workshops, correspondence and preserved instruments, this paper will reconstruct the history of the cryogenic laboratory and the technicians' workshop. I will explore the roles of the Chemistry faculty's technicians over the 19th and 20th centuries: Władysław Grodzicki (1862-1927), and three members of one family - Roman Calikowski I (1886-1940), his brother Ludwik Calikowski (1896-1961) and Roman Julian Calikowski (1915-1986).

Symposium (Part 2/3) Evolution of mathematics in China: major figures, anonymous contributors, and the giants among them (ICHM) (with IMU) - ID 69

Contribution ID: 192

A comparative examination of epistemological values utilized by Chinese mathematicians from Liu Hui to Mei Wending in solving fangcheng problems

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This presentation is aimed at examining reasoning in Chinese mathematics, focusing on the genre of *fangcheng* problems, a branch of mathematics in China equivalent to the modern-day technique of Gaussian elimination for the solution of systems of simultaneous linear equations. As the computational procedures to solve *fangcheng* problems vary, the objective is to identify and highlight the epistemological values endorsed by certain major figures in their treatment of this genre to promote certain procedures over others. The analysis will be based on the following works: the commentaries on the *fangcheng* Chapter in the *Jiuzhang suanshu* 九章筭術 (Nine Chapters on the Art of Mathematics) by Liu Hui 劉徽 (fl. 3rd century CE), Yang Hui's 楊輝 (1238–1298 CE) commentaries on *fangcheng* problems in his *Xiangjie jiuzhang suanfa* 詳解九章算法 (Detailed Explanations of the Computational Methods in the Nine Chapters), a chapter in *Tongwen suanzhi* 同文算指 (Instructions for Calculation in Common Script) by Matteo Ricci (1552–1610), and Li Zhizao 李之藻 (1565–1630), and finally, *Fangcheng lun* 方程論 (Discussions on Juxtaposition and Calculation) by Mei Wending 梅文鼎 (1633–1721).

Contribution ID: 195

Pitiscus' numerical solution for sin 1° and his influence on Chinese mathematic

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[2]*Institute for the History of Natural Sciences, Chinese Academy of Sciences, Beijing, China*

Since the Ptolemaic era (about 90–168 CE), the exact value of sin 1° is related to the overall accuracy of the sine table. The Persian mathematician Jamshīd Mas'ūd al-Kāshī (1380~1429) made the first breakthrough on this issue. This problem also plagued many European mathematicians in the 16th century, when he German mathematician Bartholomaeus Pitiscus (1561–1613) made the first significant advances. This presentation will focus on the analysis of Pitiscus's approach for determining the numerical value of sin 1°, comparing it to al-Kāshī's algorithm, and discussing the influence of these mathematicians on the development of Chinese mathematics, despite the fact that they never visited China themselves.

Contribution ID: 344

The Position and Influence of the 13th-century Chinese Mathematician Yang Hui in the History of Chinese Mathematics

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Yang Hui is one of the most significant mathematicians from 13th-century China. Recently, considering his works in terms of mathematical practice, it is clear that some of Yang Hui's ideas have not been fully appreciated. Yang Hui's work had its own characteristics, compared to other significant mathematicians of his time. Three mathematicians in particular, Qin Jiushao, Li Ye, and Zhu Shijie all studied new problems and obtained important original results. Yang Hui has been portrayed as having obtained no original results of his own. This is a misunderstanding. Yang Hui attached great importance to algorithms. He tried to reorganize ancient mathematics from the perspective of algorithms, so as to establish a new framework. He put forward the idea of establishing a mathematical model, which he summarized as "analogous algorithms for calculating areas." His use of mathematical models was not unique at this time. Li Ye and Zhu Shijie also created their own models to construct new problems for displaying their mathematical ideas, while Yang Hui constructed his models for the purpose of unifying algorithms. His detailed description of the processes of mathematical practices was not only convenient for his readers to understand and follow, but also provided good material for historical research. His mathematical thoughts and works have had a far-reaching influence on the development of mathematics in China.

Contribution ID: 323

New Arguments on the Relation Between Geng Shouchang and the Compilation of the Nine Chapters on Mathematical Procedures

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Liu Hui recorded that Zhang Cang (prior to 252 BCE-152 BCE) and Geng Shouchang (fl. Mid-first century BCE) collected the materials of the ancestor of the Nine Chapters on Mathematical Procedures (Jiuzhang suanshu) that survived from the "burning of books" policy enacted by the First Emperor of the Qin Dynasty (r. 246/221-210 BCE).
Some scholars reject what Liu Hui records, and therefore not enough attention has been paid to Geng Shouchang. Prof. Guo Shuchun holds that the main contribution made by Geng was to supplement some of the problems in the Nine Chapters. Combining unearthed bamboo materials with the sources handed down through the written tradition, this presentation will offer strong evidence to demonstrate that it was indeed Geng Shouchang who compiled the Nine Chapters based on its previous edition. He unified the usage of measurement units throughout the whole book, and distinguished the units shi and hu representing weights and volumes, respectively. It is difficult to find problems in the Nine Chapters that adopt the measurement system with the unique characteristics of Geng's time, or that reflect the background of his actual work. This means that Geng Shouchang greatly respected the original content of the work at his disposal and seldom added new types of problems as he was compiling the Nine Chapters. In addition to his unification of the measurement units, Geng may also have modified certain expressions in the older texts, as well as the organization and format of the contents in the Nine Chapters.

Session X (Part 2/2) - Diplomacy, behavior

Contribution ID: 1132

Utilization of academic models in modern industrial fields (sericulture) at the beginning of the 20th century

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Scientific knowledge of silkworms *Bombyx mori* was introduced from Europe to Japan in the second half of the 19th Century with the spread of pébrines and the export of raw silk thread in Europe. We confirmed approximately 50 types of silkworm models originating from the first "Sericultural Institute" (established in 1896), Japan's first government-owned specialist sericulture research and education body. The era of production is estimated to have been around the first half of the 20th Century (1902−1933). A wide range of materials was involved, such as wax, papier-mache, plaster, as well as silkworm anatomical models, physiological models, sexing models, and pathological models. Some of these materials were confirmed to be domestic products according to plates and external appearance. In addition, based on the literature concerning the papier-mache models, it has been shown that Choshichi Yamakoshi created these between 1902 and 1907. In the second half of the 19th Century, Dr Louis Auzoux studio papier-mache anatomical models were exported into the world ; they are known to have contributed to the development of modern medicine and science worldwide. However, hardly any case

studies are known on the academic models in industrial fields. These materials demonstrate the application of academic models in industrial areas (modern sericulture).

Contribution ID: 1244

Giants and dwarfs: changing image of expert, his/her place and role in science history

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Traditionally, expert is a person with some position in social structure: a) as expert knowledge holder; b) as the one whom others address as expert assigning (allotting) this role. Expertise space is formed in circle of relationship: of one that knows the subject and can get outside perspective, and political decision-makers. In 20th century there was evolution of expertise. Third order of relationship appeared: relations with mass media, with those to whom expert can sell his/her (even doubtful) knowledge of subject in view of big up his/her symbolic status. Political decision-making unit cannot but contend with persuasive and aggressive advertisement forming audience's confidence to symbolically significant experts' knowledge. Expertness proliferates: reputable person is invited to be expert at the slightest pretext. Expertness model complicates in favor of bureaucracy surrounding decision-making unit that fulfils expert selection function (most commonly selecting loyal experts). In modern "knowledge society" with increased specialization and complicated knowledge an expert is a marginal able to talk about subject but not using subject language that scientist uses. Thanks to media influence and knowledge popularization phenomenon, expertise gets its own language that might have own rules and be taken for scientific language. Expert starts competing with scientist. Report seeks to present scientific expertise criteria transformation from "knowledge communism" (classical scientific ethic norms) to forms related to academic order's place change in "knowledge society" because of other knowledge orders (military, bureaucratic, economic, legal etc.) coming and domination, and to show how science mediatization changes beliefs about scientist.

Contribution ID: 1033

A Preliminary Study on Overseas-returned Chinese Architects in the First Half of 20th Century——based on Academic Pedigree

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Ancient China created a unique and brilliant system of Chinese classical architecture but failed to form a systematic and scientific architecture discipline. The research paradigm and analysis method of Chinese modern architecture originated from overseas: since the 20th century, the early overseas students came back and gradually introduced a modern architecture system. Based on the lack of systematic analysis of the paradigm shift of modern Chinese architecture, this paper takes the group of Chinese architects returning from overseas study in the first half of the 20th century as the research object and attempts to discuss this issue from the perspective of academic pedigree. Academic pedigree is an academic community composed of scientists of different generations who are linked by academic inheritance,

which can reflect the academic origin, mentoring relationship, and academic tradition of relevant groups of scientists. As for the group of returned architects who studied abroad in the first half of the 20th century, this paper sorted out the overall situation of their research on architecture and modern architectural design based on local conditions by stages and analyzed the academic origin, establishment process and academic tradition of modern Chinese architecture.

Symposium (Part 2/2) DISHAS and recent research on the history of astronomical tables: Latin, Sanskrit and Chinese sources (CHAMA) - ID 77

Contribution ID: 1327

Shanati: A Project to Reconstruct the 1st Millennium BCE Ancient Babylonian Chronology to the Day

Alexander Jones, **David Danzig**
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Although commendable for its ingenuity in its day, the Babylonian chronology of the first millennium BCE reconstructed by Parker & Dubberstein (1942, 1956, 1971) is lacking in several regards. They provide textual evidence for most intercalary months, but little for month length, the basis of a complete daily reconstruction. Instead, they rely on an astronomical model of first lunar visibility. First implemented by Schoch (1928), their model has more recent competitors, and is unverified against ancient evidence. In addition, significant work on chronological cruxes at regnal transitions has been accomplished in the last 50 years. Finally, Parker & Dubberstein did little to investigate the ancient methods of making calendrical decisions.

Shanati is working to overhaul the daily ancient Babylonian chronology by addressing all of these issues. The basis of Shanati will be the collection and integration of all available textual evidence (mainly in cuneiform economic and scholarly texts), from among the 80,000+ potentially relevant texts. For interludes of no textual evidence, a newly calibrated astronomical model for first lunar visibility will be relied upon. Therefore, Shanati's chronology will give the best possible daily timeline and conversion to proleptic Julian dates.

Alexander Jones, Director of New York University's Institute for the Study of the Ancient World, is Shanati's Principal Investigator, and David Danzig, doctoral candidate at ISAW, is the project's Creator and Lead Researcher. We wish to express our gratitude to the National Endowment for the Humanities for its award of a Digital Humanities Advancement Grant to fund Shanati.

Bibliography:

Langdon, Stephen, John K. Fotheringham, and Karl Schoch. *The Venus tablets of Ammizaduga, a solution of Babylonian chronology by means of the Venus observations of the first dynasty*. London: Oxford University Press, 1928.

Parker, Richard A., and Waldo H. Dubberstein. *Babylonian Chronology 626 B.C.–A.D. 45*. Chicago: University of Chicago Press, 1942.

Parker, Richard A., and Waldo H. Dubberstein. *Babylonian Chronology 626 B.C.–A.D. 75*. Brown University Studies 19. Providence, RI: Brown University Press, 1956.

Parker, Richard A., and Waldo H. Dubberstein. *Babylonian Chronology 626 B.C.–A.D. 75*. 4th printing 1971. Brown University Studies 19. Providence, RI: Brown University Press, 1956.

Contribution ID: 114

The numerical differences of the two versions of Ḥabash al-Ḥasib's astronomical tables

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Ḥabash al-Ḥasib (d. after 864 CE) is considered the most ingenious mathematician of his time. His astronomical tables are extant in two manuscripts which differ considerably in their respective texts (Debarnot 1985). The numerical tables are not identical and their numerical differences have a systematic character. In a previous study it was shown, that in the earlier version (MS Istanbul Süleymaniye Library, Yeni Cami 784) the values for the declination of the sun were calculated for every third degree and interpolated for the values in between (Thomann 2010). But in the later version (MS Berlin Staatsbibliothek Wetzstein I 90) no linear interpolation was applied. As it seems, a lot of effort was invested by the compiler of these latter tables. Therefore it seems promising to extend the analysis on other tables in the two manuscripts.

References:
Debarnot, Marie-Thérèse (1985), "The Zīj of Ḥabash al-Ḥāsib: A Survey of MS Istanbul Yeni Cami 784/2", *Annals of the New York Academy of Sciences* 500, pp. 35–69.
Thomann, Johannes (2010). "Die zwei Versionen astronomischer Tafeln von Ḥabaš al-Ḥāsib: Ein editorisches Problem".Paper held at the *31. Deutscher Orientalistentag, Marburg, 20.–24. September 2010,* published at the Zurich Open Repository and Archive, University of Zurich (https://doi.org/10.5167/uzh-46853).

Contribution ID: 317

The emergence of auxiliary astronomical tables in medieval Europe

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Auxiliary astronomical tables were a substantial and extensive tradition in medieval Islam, beginning as early as the 9th century. These tables, computing functions that are more complicated than primitive trigonometric quantities but with no direct astronomical application, arise naturally in the context of spherical astronomy where solutions to different problems often share mathematical elements. We are fortunate to have two treatises with the same title — the *Tabulae primi mobilis* — that allow us to trace the gradual birth of the idea of auxiliary tables in the works of their European inventor, the Italian astronomer Giovanni Bianchini, leading to their fullest realization in his *Tabulae magistrales*. Repeating the evolution in medieval Islam, one of these original auxiliary tables evolved into what we now call the tangent function. Regiomontanus copied Bianchini's idea in his *Tabulae directionum* but took the notion much further in his single giant auxiliary table, his *Tabula primi mobilis*, a table whose idea would be

rediscovered several times in following centuries. We shall trace the development of auxiliary tables from its European origin in the 15th century through the end of the 16th century.

Contribution ID: 1325
Demonstration of DISHAS, Digital Information System for the History of Astral Sciences

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Session II (Part 3/3) - Biological Sciences

Contribution ID: 1063
Morphine, alcohol, and the victorious body: how intoxicants intersected bodies and minds in the development of the biological subject

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Drunk, inebriated, besotted, boryeyed, muddled, and exhilarated—intoxication of many kinds, and even more names, is at the heart of an untold story about shifting perceptions of psychology, subjectivity and bodies found toward the end of the 19th century. Substances of intoxication can be found quietly skulking in nearly every nook and cranny of our society. However, little thought has been given to their formative role in the shaping of modern perceptions of the body. This paper explores the formative role of substances of intoxication in the social and scientific establishment of the biological subject in late-19th century Germany. Beginning with the reformation of the European pharmacy and the eighteenth century project of medical system building, this paper identifies the emergence of substances of intoxication as 'vital substances' and tracks the influence of this concept on the development of scientific physiology and philosophy. Particular emphasis is placed on late 19th century psychological research on the effects of intoxicants on the mind as the site of a dynamic encounter between bodies, theories of mechanism, and 'vital substances'. Here, one finds the emergence of a "biological subject" which remained fundamentally anti-vitalistic and yet is conceptually distinct from the neo-mechanism of Helmholtz, Du Bois-Reymond, and their followers. Encountering intoxicants not only calls into question the established narrative of how biology supplanted conceptions of mechanism, vitalism, and the soul but also recontextualizes the place we accord to substances of intoxication in the modern world.

Contribution ID: 1156
Biology in BAAS during the nineteenth century: T.H. Huxley and the ephemeral life of a discipline

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The British Association for the Advancement of Science (BAAS), founded in 1831, was one of the most notorious "battlefields" for the British scientific community. The scientific disciplines found their

legitimacy in the context of the association, a situation that must be understood not only from the scientific disputes but from the political ones that took place within it. Biology was not present in BAAS from the beginning but was recognized as a section until 1866. The main driving force behind this initiative was the zoologist and renowned advocate of Darwin's ideas, Thomas H. Huxley. From the historical reconstruction proposed by Joseph Caron (1988), British biology would have emerged for propagandistic reasons, and not necessarily as part of the theoretical and practical consolidation of a new field of knowledge. In this presentation, the intention is to follow Caron's argument, to show that the biology promoted by Huxley had a propagandistic intention, as far as the forum provided by BAAS was unique given its public visibility. If we consider that biology "disappeared" from the association in 1894, a year before Huxley's death, the discussion opens about the importance that a single personality can have in the advancement and consolidation of a field of knowledge. It also raises the importance of recognizing the role played by the diversity of interests around the life sciences that existed within the association.

Contribution ID: 1159

Julian Huxley, UNESCO and transhumanism: an outline of a biopolitical proposal

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Julian S. Huxley (1887-1975) was a British biologist, writer and humanist. While he is widely recognized as a scientist and scholar, Huxley also had a strong commitment to social, humanistic, and political issues. An example of the latter is the proposal of a system of beliefs that tried to link the various facets of the human being, such as culture, ethics, art and science. He called this *evolutionary humanism*. Huxley's evolutionary vision promotes an approach between the biological and the cultural, so that from there the human being can transform himself, "transcend himself", as part of his evolutionary and individual destiny. All this proposal had its origins, and also its implementation, when Huxley was president of UNESCO in 1946. If we consider what Michel Foucault and Giorgio Agamben said about biopolitics, there are elements that can be recognized in Huxley's proposal. In this presentation, it is argued that the biopolitics proposed by Huxley seeks the development (which to some extent can be understood as progress) of both individuals and society, in a liberal environment. With this, what is exercised is a biopower, insofar as it promotes a total control of life, insofar as it seeks to influence aspects such as education and culture.

Symposium (Part 1/4) Mathematical proofs and styles of reasoning: East vs. West - ID 49

Contribution ID: 94

Symbolic algebra as a synthesis of East and West

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Arabic algebra was born as a branch of practical mathematics dealing with problems of commerce, inheritance and finance. After being transferred into western mathematics, the rhetoric algebra of the Arabs slowly developed into what is usually called syncopated algebra and culminated in the work of Cardano, Bombelli and Stifel. Francois Viet introduced symbolic algebra by consciously taking inspiration from Diophantus and the Hellenistic tradition of analytic method of Pappus. In the paper I will try to characterize all three mentioned styles of reasoning – of the Arabic algebra, of the Hellenistic analysis and of Viet's symbolic algebra. I will try to answer the question of how far can the birth of symbolic algebra be explained referring only to the ancient Greek tradition (as Jacob Klein attempted) and in what sense is Viet incorporating into his *logistica speciose* also elements of the Arabic tradition (perhaps through mediation of the tradition of syncopated algebra).
Keywords: symbolic algebra; Viet; Pappus; Al Chwárizmí

Contribution ID: 238
Geometric reasoning and arithmetic reasoning in the medieval tradition of Euclid's Elements

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In this talk I explore the changing relationships between geometric and arithmetic ideas in medieval mathematics, as reflected via the propositions of Book II of Euclid's *Elements*. Particular attention is devoted to the way in which some medieval treatises organically incorporated into the body of arithmetic results that were formulated in Book II and originally conceived in a purely geometric context. Eventually, in the Campanus version of the Elements these results were reincorporated into the arithmetic books of the Euclidean treatise. Thus, while most of the Latin versions of the Elements had duly preserved the purely geometric spirit of Euclid's original, the specific text that played the most prominent role in the initial passage of the Elements from manuscript to print—i.e., Campanus' version—followed a different approach. On the one hand, Book II itself continued to appear there as a purely geometric text. On the other hand, the first ten results of Book II could now be seen also as possibly translatable into arithmetic, and in many cases even as inseparably associated with their arithmetic representation.

Symposium (Part 3/3) Knowledge of the heavens in transcultural perspectives：the circulation of astronomy and astrology between civilizations - ID 144

Contribution ID: 152
The Transmission of European Medical Astrology in Qing China

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Medical astrology, which is concerned with the astrological signatures of illness and the use of healing herbs, is an important branch of astrology in pre-modern Europe. In late Ming and Early Qing China, Jesuit missionaries introduced contemporary European medical astrology into China along with other branches of astrology. Although the introduction was limited, it had an influenced on some Chinese scholars such as Xue Fengzuo 薛鳳祚, Qing Jiangzi 青江子, who respectively tried to combined medical astrology with Chinese traditional medical theory Wuyun liuqi 五運六氣 and developed a new work Tianxing quebing shuo 天星却病說. In this presentation, we will comb the history and background of introduction of European medical astrology, and explore the medical astrology works developed by Chinese scholars.

Contribution ID: 153

A Primary Research on the Calculating Method of the Solar Eclipses in a Chinese Version of the Tychonic System (Chóngzhēn lìshū 崇禎曆書)

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In the late Ming dynasty, European astronomy was introduced into China. During an astronomical reform launched in 1629, the Chóngzhēn lìshū ***崇禎曆書*** (Chongzhen-Reign Treaties on Calendrical Astronomy, CZLS), an encyclopedic series of treatises on European mathematical astronomy, was compiled. In this work, the Tychonic system was adopted as the core theory. However, in CZLS the eclipse theory, which was an important part of Chinese astronomy, was not clear and complete enough, . Not only was the method for calculating the astronomical tables not explained in the part of the theoretical fundamentals, but also it failed to provide a detailed procedure for calculating luni-solar eclipses by using tables. In this research, through analyzing the astronomical works connected to Tychonic eclipse theory in the late Ming and early Qing period, we will try to reconstruct the exact and complete methods for calculating a solar eclipse by using geometric models and astronomical tables in the CZLS. Moreover, a comparison between the results of calcualtion based on our reconstructed method and the predictions of solar eclipses in the Chongzhen reign period recorded in historical materials will be presented.

Contribution ID: 179

A public cosmology lecture with a clockwork astronomical model in 18th century Japan

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This paper explores the content of a cosmology lecture given to the public in 18th century Japan, using a clock-driven astronomical model.
Minamoto Keian (1648-1729), a physician and Shintoist in Kyoto, began his book *Honcho Tenmon* (Astronomy of This Country) with a diagram of a spherical astronomical model he had invented and named *Santengi* (Three luminaries instrument). Minamoto claimed that his device, a kind of astronomical model driven automatically by clockwork, could make models of the sun and moon turn on rings inside the sphere at appropriate speeds, so as to show their true motions.

After Minamoto's death, his *Santengi* became the property of Gangyo-ji temple in Kyoto, where an exhibition was held every winter solstice day for the curious public, accompanied by a lecture on cosmology.
A newly discovered manuscript titled "Honcho Tenmon Santengi Koben (Text of lectures on the *Astronomy of This Country* and the *Santengi*)", dated 1754, gives a detailed report of the lecture, from which we also gain information about questions raised by the audience.

This public lecture in 18th century Japan inevitably reminds us of the famous painting by Joseph Wright "A Philosopher Lecturing on the Orrery" in England of the same period. However, such a lecture for the public using an elaborate scientific model had never been known in East Asia before that time.
In this paper, we first analyze the content of the lecture report in detail and, secondly, discuss the significance of scientific topics in the popular culture of 18th century Japan.

Contribution ID: 472
The Non-Ptolemaic Islamic Star Tables in the Huihui-lifa and the Sanjufini-zij: Focusing on the analysis of precession and epoch

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In the early Ming China. a Persian-zij of Yuan dynasty was translated into Chinese in 1385, and a Chinese-Islamic calendar, Huihui-lifa based on the Persian-zij was compiled by a group of Chinese and Muslim astronomers in 1396. This early version of Huihui-lifa is not extant, but it was newly revised by Korean astronomers in 1444, under the name of Chiljeongsan Oepyeon. Also, it was revised by a Chinese astronomer Bei Lin in 1477, which is called the Qizheng Tuibu. Two version of Huihui-lifa, the Chiljeongsan Oepyeon and the Qizheng Tuibu include the Non-Ptolemaic star tables which give the longitudes, latitudes, and magnitudes of 277 stars in a region within ±10° of the ecliptic plane. Interestingly, it is known that these star tables have common origin with a star table of the Sanjufini-zij written in Tibet. According to the historical records, a star table (epoch 1391) in the Chiljeongsan Oepyeon was completed in 1396 and the precession is given as 4′ per 5 solar years. Meanwhile, the star table (epoch 1363) in the Sanjufini-zij was compiled in 1366 and the precession is given as 4′ per 5 lunar years. The precession recorded in the both star tables are different, but their values give us some clue to solve their origin. This study examine the star tables in the Huihui-lifa, Chiljeongsan Oepyeon and the Sanjufini-zij. Through the analysis of their precession and epoch, we trace their origin and transmission route, and discuss on the similarity and dissimilarity among them.

Symposium (Part 2/2) To explore from West to East: persons, methods and results - ID 82

Contribution ID: 102
Reconstructing British and Russian envoys/expeditions to Japan at the end of the 18th century in relation to Daikokuya Kodayu

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Since the early 17th century, Japan closed off the door to the western countries except for Netherlands through the trading with the Dutch East India Company. Until the end of the 18th century, diplomatic and economic interests in the Far East had been increasing among other European countries, i.e., Britain and Russia. Both countries regarded a shipwrecked Japanese in Russia, Daikokuya Kodayu, as a key figure to contact Japan. This presentation compares two envoys to the Far East by Britain and Russia, which were conducted contemporary. In 1792, Britain sent Lord Macartney as it's first envoy to China, and subsequently, planned to proceed to Japan, which he did not realize. In the same year, Russia sent Adam Laxman, a son of Kirill Laxman, and sent Kodayu back to Ezo, modern day Hoddaido. The Laxman expedition marked Russia's first official contact to Japan, which brought Russian and European knowledge to Japan through Kodayu. This presentation discusses persons involved, the methods, and their results, as well as focusing on the objects they took to Japan and brought back to their countries. Objects, images and archival sources which are still existing in both Europe and Japan clearly show not only British and Russian diplomatic and economic interests but also scientific interests, especially of natural history in the Far East in the late 18th century.

Contribution ID: 131

Development of one of the world's largest zoological collections: collecting for Zoological museum in Stankt-Petersburg in 19th - early 20th century

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The collection of the Zoological Institute in St. Petersburg, that has been named Zoological museum before 1931, is one of four largest collections of this kind (60 million items) in the world. It is a real Giant amongst research institutions in the field of zoological taxonomy. In this report we are going to analyze how this collection reached the dominant position among other zoological collections of Russia and what was the ways of enlargement of it through the period from 1832 to 1917. Material for analyses is taken from the Reports of the Meetings of the Physics and Mathematics Department of the Academy of Sciences and since 1895 from the Books for Registration of Collections. The sources of collections have changed through time. First it was mainly purchase, exchange and donation from a small amount of animal lovers and specialists, who participated in rare expeditions. Step by step the quantity of these persons became larger. Those who did not serve at the Academy started to play a significant role (37 people were elected the correspondents of the Museum since 1895). In addition, collections were composed by persons who were given the necessary instructions, subsidies and equipment (in some years 92 collectors of insects and 80 people who received utensils, alcohol and tools for collecting). This expanded the actual staff of the Museum (in 1914 altogether 34 people, scientific staff – 12). For such persons the Museum has published in 1888-1936 a series of "Instructions for gathering of the collections."

Contribution ID: 458

Meteorological observations in research programs of the Russian expeditions to Central Asia at the turn of the 20th century

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In the late 19th and early 20th centuries, the Russian Geographical Society (RGS) initiated several large-scale expeditions to China, Eastern Tibet, Mongolia. The primary task of those expeditions was to erase numerous unknown 'white spots' from the map of Asia. At the same time their research programs also included a few other specific fieldworks: topographic survey of the entire caravan route, various instrumental observations, including meteorological measurements and undertaking natural collections. As for meteorological observations, for a long time, they were carried out exclusively along the course of the expedition caravan and included measurements of air temperature, humidity and pressure three times a day. Such meteorological data gave a very rough picture of the area weather and climate conditions. The first stationary meteorological station in the RGS expeditions in Central Asia was created by M. Pevtsov during his Tibetan expedition in the Niya oasis in 1890. As a result he collected a great amount of important data necessary for climate study in that region. Later the arrangement of stationary weather stations was always included in RGS large-scale expeditions programs. The duration of their work ranged from four months to two years. The leaders of the expeditions received recommendations on the arrangement of weather stations, measurements and collecting of data from the Main Physical Observatory, St. Petersburg Academy of Sciences.
The paper will consider the features of RGS expeditions meteorological observations: weather stations organization, their methods and tools, further expertly processing of the results.

Symposium (Part 1/2) New perspectives: differentiating cultures in ancient mathematics (IASCUD) - ID 527

Contribution ID: 608
Cultures of quantification and computation as testified by the Śulbasūtras

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The oldest mathematical texts that have been handed down to us from South Asia, collectively known as the *śulbasūtra*s (Chord treatises), are a group of texts of different belonging to separate schools of Vedic ritual. The oldest such texts the Baudhāyana or Apāstamba *śulbasūtras* might have been composed around 600 BCE while others such as the Hiraṇyakeśi, Mānava and Kātyāyana could have been devised and re-edited after that and as late as the 3rd century CE. These texts contain procedures and definitions related to the construction of ritual spaces, sacrificial altars but also general mathematical considerations. They often have common parts, and sometimes quote one another. The *śulbasūtra*s were first edited and translated into English in the late 19th century and further studied and re-edited through out the 20th and 21st century in the works of historians of mathematics such as B. Datta to more recently J. M. Delire. In contrast with a historiography of mathematics that overall tends to view their mathematical contents as being homogeneous, this paper will look closely at the different ways in which constructions of the areas of sacrificial grounds may rest on different practices and maybe

conceptions of the relations of numbers and measuring units to elementary geometrical figures (right triangles, rectangles and trapeziums). As such then we hope to investigate the different practices of quantification in relation to geometrical figures and of computation in geometry as testified by different *śulbasūtra*s.

Contribution ID: 621

Variety in a uniform tradition: A comparison of metrology and mathematical education in Old Babylonian sources

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Cuneiform mathematics is often perceived as a single, uniform entity. This unity was practiced in the same manner throughout Mesopotamia and beyond. While it's admitted that there is regional variety in sign use and writing, modern works often treat mathematical activity in Mesopotamia as uniform. This is the case whether, for instance, a text was produced at Nippur in the heart of Babylonia, at Eshnunna of the Diyala region, or at Susa in modern Iran. Challenging this view, the current presentation will explore variety within the cuneiform mathematical tradition. It will propose the examination of three kinds of texts, based on their production source: texts of student practice, texts of erudite practice, and texts of professional practice. These distinct text types are chosen to isolate distinct mathematical practices based on region and profession. As a case study, metrology within the Old Babylonian Kingdom of Larsa (the early second millennium BCE in southern Iraq) will be examined. Metrological values found on lists and tables from three distinct cities (Larsa, Ur, and Nippur) that were memorized early in a scribe's education are explored and compared to values found on both mathematical and administrative texts to show that there were different, distinct schools within this kingdom with their own distinct metrological traditions and that these traditions had an effect on mathematical practice of the actors produced by these traditions. Thus, the listener will discover a distinct regional variety in cuneiform mathematics as well as the significance of this variety for individual practitioners.

Contribution ID: 661

An analysis of the Double-Fourteenth Book in Billingsley's translation of Euclid's Elements

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Henry Billingsley published the first English translation of Euclid's *Elements* in 1570. His work included a lot of additional "corollaries", "demonstrations", "assumpts", "propositions", and notes from forty scholars. Billingsley's translation contained Books XIV and XV, which Hypsicles of Alexandria is supposed to have added to the *Elements*, and which discuss the ratio between Platonic Solids when one is inscribed or circumscribed in the other. It is worth noting that Billingsley put two different Books XIV in his translation, which are called 14A (Hypsicles, Zamberti and Flussates) and 14B (Hypsicles, Flussates and Campanus) for convenience. The double-fourteen book sheds light on two different aspects of Billingsley's translation, on which this talk will focus. Firstly, Billingsley paid a lot of attention to the research on Euclid's *Elements* carried out by previous translators. His edition attempted to unify the

various traditions of the study of the *Elements* that existed at the time. These included the tradition embodied by the Arabic works written during the Abbasid period, the Latin tradition in the Renaissance and Hermetism. Secondly, the revival of Platonism had a noticeable influence on Billingsley's attitude towards the interpretation of solid geometry. For example, he proposed that "number" and "quantity" could work together to interpret the significance of solid geometry in natural philosophy, as well as the status of solid geometry in the structure of mathematics.

Contribution ID: 890

Differentiating two practices and the underlying epistemic principles in the "rule of three" procedures in China

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When the Jesuit Matteo Ricci and his Chinese collaborators introduced the "rule of three" from Europe into China in early 17th century, they identified this proportional procedure with "Multiplying by the different and dividing by the same" (*yicheng tongchu* 異乘同除, hereafter MDDS), a method which had been discussed in Chinese mathematical texts for about four centuries. What does the name MDDS exactly mean? The procedures that correspond to this name in Chinese mathematical texts present differences and this fact suggests that there existed two approaches to determine "the different" and "the same". Moreover, a procedure named "suppose" (*jinyou* 今有) in the ancient Chinese mathematical canon from about the beginning of the common era, *Mathematical Procedures in Nine Chapters* (*Jiuzhang Suanshu*), was also a version of the "rule of three", from which the method MDDS derived. Philological evidence from the base text and the commentaries of this canon shows that there also were two different practices of operating and employing the "suppose" procedure, and two corresponding considerations on the relationship of those involved objects. Drawing on these investigations, we will highlight the two practices of the "rule of three" procedures in China and show that their underlying epistemic principles enjoyed some continuity from scholarly writings to popularized texts, and from ancient to medieval times. Further, this study will cast light on why and how Chinese scholars in the 17th and 18th centuries integrated the introduced mathematics into their own tradition — through a shared mathematical culture.

Symposium Military research and the militarization of research in Cold War Europe - ID 346

Contribution ID: 405

The military origin of computing and long-term planning in Cold War Sweden

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In our paper, we explore the military origin of computing and long-term planning in Cold War Sweden. By tracing the shared roots of these technologies to the governmental agency *Swedish Defence Research Institute* (FOA), we intend to investigate a process of militarization often neglected in Swedish scholarship. This would place computing and long-term planning as parts of a process where national security became the overarching goal for society and military practices part of everyday life.
In the 1950s, computing and Operational Research were parts of the same military-scientific field within FOA, but these technologies then spread across the scientific community along quite different paths. Computing became an academic field in the 1960s, along with the establishments of university data processing centres. The most advanced of these was set up and run by former defence researchers and the enterprise was influenced by practices originating from FOA. Operational Research diverged from computing in the 1960s, when analysts at FOA explored new forecasting technologies. The Swedish government's increasing interest in future studies, program budgeting and conflict studies during the late 1960s was a product of cooperation between social scientists, economists and military officers employed at (or financed by) FOA.
We argue that both computing and long-term planning in Cold War Sweden were shaped by their connections to military research. This conclusion nuances the Cold War history of technology by reinterpreting the scientific knowledge production in a small neutral state.

Contribution ID: 736
The hidden university: The military research institutes as knowledge producers in Cold War Sweden

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The aim of the paper is to discuss the role of Sweden's military research institutes as knowledge producers in Cold War Sweden. Swedish military research during the period was a prioritized national security concern that commanded a major proportion of the nation's total research funds. Furthermore, it was concentrated to the most advanced areas in scientific and technical research. We argue that Sweden's military research has played a crucial but largely unknown role for the development of post-war civilian research.
In parallel with the build-up of the military research system during the 1940's to the 1970's, a state funded civilian research system was formed. We argue that the military research institutes functioned as 'the hidden university' of the Swedish research system. As such they produced both research and researchers in close connection with and for industry and academy. We aim to demonstrate that military and civilian technical research mutually constituted each other.
In this paper we follow the career paths of the researchers within the military research institute Swedish Defence Research Establishment *(Försvarets forskningsanstalt)* and trace their connections with and movements between military, industrial and academic research milieux.

Contribution ID: 944
"Entirely at your service, except [….]". Dutch scientists and military research during the Cold War

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At first glance, the impact of Cold War military research on the Dutch research system might seem limited. Rare historiographical accounts are limited to individual laboratories or scientists happened to work in this remote field. Explanations for this include Dutch focus on international legal order, global trade and pacifism. Yet, the country was also enthusiastically accepting American aid for the post-war reconstruction of science and was sensitive to pressure for increasing defense spending. Indeed, a closer look reveals a fascinating image of newborn laboratories, connected to industrial companies and academic life. Illustrative is the work on digital fire control system, carried out in military laboratory headed by a professor, and developed by a corporation, who's director was the ex-Minister of War. Several 'scientists in uniform' set up these type of militarized laboratories after their war-years in London. The Medical-Biological Laboratory, firmly grounded in a militarized institutional context, carried out successful fundamental research, to the point that it was being described as a breeding ground for professors. The overarching National Defense Organization was headed by a civilian scientist, eager to pursue 'pure science' for the benefit of (Christian) mankind. At the same time, he stressed that his organization was permanently at the Army's service, provided he was not given any orders. Increasingly, he was balancing in between the military demands for applied technology and the scientific quest for fundamental research. Following his career, conflicts and compromises pass, thereby shedding new light on post-war Dutch science and its militarized areas of research.

Contribution ID: 947

Industrial and military research in the Versuchsanstalt Pibrans during Nazi occupation and its Cold War continuation

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We study the interactions between industry and academia in Czech academic community, in our case Spectroscopic institute of Charles University in Prague and Skoda Company. We show how their research agenda was militarized during WW2. The contracts from Wehrmacht stimulated Skoda to build its own research infrastructure. The new institute, Versuchsanstalt Pibrans (German name of the town Příbram), was set up within the holding Waffen-Union Skoda-Brünn owned by Reichswerke Hermann Göring. It also enabled the junior members of the research group to continue their research after the Czech universities were closed by the Nazis.
In the end of 1944, Versuchsanstalt für Strahltriebwerke was evacuated from Grossendorf to Pibrans and its head Rolf Engel took over the administration of the joined institute in Příbram. He focused its research programme on ballistics, with the rocket V-101 as the most ambitious project. He and his deputy, Swede Niels Werner Larsson, were involved in rocketry also after WW2, in Egyptian Rocketry and Soviet Cosmic Research and Rocket Development, respectively.
Nazification of the research under Engel supressed the activity of Czech researchers and their results were utilized only after the war ended. Later, several patents were granted to the members of the group. We trace their careers to show how these people migrated among industrial companies, military research institutes, Czechoslovak Academy of Science and universities. That also supports the proposed hypothesis of the 'hidden universities' in Czechoslovakia, where industrial research institutes supported academia both during the World War 2 and Cold War.

Retrospective bibliographical index - a universal source for history of science

Contribution ID: 1228

Retrospective bibliographical index - a universal source for history of science

Birute Railiene, Giedre Mikniene
Scholarly Information, Wroblewski Library of the Lithuanian Academy of Sciences, Vilnius, Lithuania

Each country seeks to register its published scientific materials in national bibliographic publications. This ensures dissemination of scientific results and, in the long run, creates bibliographic sources for national culture, education and the history of science. National bibliography may be classified into current and retrospective bibliography. Our study deals with the latter, according main attention to the role of bibliographic sources in exploring the national cultural and scientific heritage of a nation from the historical perspective and putting emphasis on works in this field carried out in the Wroblewski Library of the Lithuanian Academy of Sciences.
"Bibliography of Lithuania" is a vital source of information for research in the history of science not only in Lithuania, but also neighboring countries (Latvia, Estonia, Poland, Belarus, Russia and Ukraine). The structure of the bibliography facilitates learning the history of individual science fields and recognizing trends in their development in a certain time period. It also gives insight into the activities of scientists and scientific institutions of the times.
The Wroblewski Library of the Lithuanian Academy of Sciences has considerable experience in compiling bibliographic indexes and creating databases. The Library publishes volumes of "Bibliography of Lithuania. Series C", encompassing the publications from 1898-1903, also 1924.
This presentation will discuss, from both the local and international viewpoint, the role of national bibliography as a source for the history of sciences and as a means of research. It will offer a comparative analysis of data from several countries.

Contribution ID: 1232

Polish Current Bibliography of the History of Science and Technology at the Institute of the History of Science, PAS

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The development of the history of science and interest in this field of knowledge by scholars, philosophers and historians made it necessary to create a tool for easy searching of this type of literature scattered in domestic and foreign journals and books. The aim of the paper is to present the history of preparing and publishing this type of bibliography at the Institute of the History of Science of the Polish Academy of Sciences, as well as make an attempt to continue it nowadays; it also reminds about its and describes its thematic scope. The beginnings of creating a bibliography at the Institute date back to 1966, and the formal date of its establishment is 1971, when the first issue of "The Current Bibliography of the History of Science and Technology" was published as a supplement in No. 3 of the *Quarterly Journal of the History of Science and Technology*. The collection was published by the end

of 2007 (its publishing was discontinued for financial reasons). In 2018, at the Institute of the History of Science of the Polish Academy of Sciences in Warsaw, work began on reactivating the collection. Currently, two issues have been published in the journal: "Analecta. Studies and Materials from the History of Science" (No. 2/2019 for 2018 and No. 2/2020 for 2019). Ultimately, there is a plan to create such a database on the Internet.

Symposium Environmental policy, mining, and recultivation in East and West Germany. Brown coal of the Lausitz, Wismut, and the Ruhr (1949-1989/2000) (ICOHTEC) - ID 522

Contribution ID: 697

The coal mining spoil heaps in the Ruhr area and their integration in the landscape

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In the Rhine and Ruhr area the start and development of coal mining was an immediate and dominating part of the overall development of this region.
The side effects of coal mining operations are above-ground accumulations, which remove spoil and waste materials from the coal. These waste materials are tipped and deposited as heaps. In 1981 the "Kommunalverband Ruhrgebiet" counted 235 spoil heaps with a total area of 2.555 ha. Mine spoil heaps are artificially made mountains created by humans in a usually flat landscape with heights reaching up to 140 meters and several environmental problems are connected to their existence.
Up until the end of the 1940s their existence was widely accepted as a necessary evil for the greater good of coal mining. In the early 1950s initiatives by the "Siedlungsverband Ruhrkohlenbezirk" and the "Schutzgemeinschaft Deutscher Wald" began to recultivate mine spoil heaps based on the premise of damage control. Since then, these efforts greatly increased and the main goals were not only the recultivation but their integration in the landscape. Beginning in 1989 the "Internationale Bauaustellung Emscher Park" changed the narratives surrounding heaps once more. Instead of looking at them as problems the initiators saw them as part of the cultural identity of the Ruhr area.
Analyzing mine spoil heaps in the Ruhr region can help to understand the changing relationships between human and nature and demonstrates how humans shape their surroundings, but also how nature influences how humans classify regions.

Contribution ID: 705

Soil and socialism. Recultivation of lignite mining in the German Democratic Republic

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The German Democratic Republic (GDR) depended on lignite and extended this industry to make the country economically self-sufficient. The result of opencast mining from the end of the 19th century onwards caused ecological damages and left thousands of hectares of "moon landscapes". Yet, the environmental history of the socialist states is often described as an "ecocide". But does the theory of socialism not imply a responsible dealing with the natural resources? In 1950, the pioneer of landscape gardening and convinced socialist Reinhold Lingner started the first nationwide environmental monitoring focussed on the destruction of lignite mines. At the same time, his opponent Georg Pniower initiated a project for the recreation of slag heaps and mine dumps, executed by Wilhelm Knabe. This was the beginning of the science of soil reconstruction. An research network was built, including the universities of Berlin, Dresden and Leipzig as well as several independent departments. The main objective was to find a proven and feasible method to ameliorate the acid tertiary soils. Between 1952 and the end of the 1960s, five technologies were developed dealing with the specific problems for different types of mines. Specialized machines were constructed and rare resources had been replaced by cheaper products. By integrating these methods into the mining process, the GDR became in the 1960/70 leader in the recreation of industrial wastelands – a notable result for a socialist state. Thus one could say that the common historical narrative, which emphasizes the lack of innovation in socialism, is at least questionable.

Contribution ID: 734

Environmental Policy and the Uranium Ore Mining in East Germany, 1946-1990

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Between 1946 and 1990, the joint Soviet-East German stock company *Wismut* produced an enormous amount of uranium for Moscow and its nuclear weapons program. The uranium exploitation in East Germany led to severe air, water and soil pollution in a very densely populated area. The exploitation of uranium in East Germany made a quick development of the Soviet nuclear bomb possible, and provided a steady supply to increase the quality and quantity of the Soviet nuclear arsenals. During 1990/1991 uranium ore mining ended in East Germany. In the following years an enormous financial, technological and scientific commitment took place in order to deal with these environmental disasters and to remediate wasted landscapes. This again led to the development of new technologies and methods of remediation, recycling and reclamation. However, this development did not just begin after the decommissioning of mining and milling sites in 1991. Already, in the late 1950 the Wismut was aware of enormous water and soil pollution in the area of its mining and production sites. In the 1970s and 1980s the Wismut developed new methods to cover tailing ponds and mine dumps, to implement wastewater treatment and to remediate entire landscapes. Nevertheless, the severe water and soil pollution was understood as very unpleasant but unavoidable byproduct of the uranium mining industry. The project is analyzing the decision making process how the Wismut, the GDR and the Soviet Union handled the environmental problems and how production sites, heaps, mines and tailing ponds were remediated, re-cultivated and re-naturalized.

Symposium (Part 3/3) Great to small: spatial and temporal scales in the history of the geosciences (INHIGEO) (with IUGS) - ID 505

Contribution ID: 671

Scale in the history of geology: dinosaurs and ostracods

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In Japan many dinosaurs fossils are dug out, but it is only after 1979. People thought there were no dinosaurs in Japan, because all Mesozoic strata in Japan are marine. In 1979 Tetsuro Hanai (1924-2007) and his student Tomoki Kase found dinosaurs fossils from the Cretaceous marine strata in Moshi, northern Japan. Moshi ia a famous locality for many fossils, but no one discovered dinosaurs before 1979. Hanai was the professor of palaeontology of the University of Tokyo. His major of very small crustacean Ostracoda. He had smart thinking of fossils as organisms in the past, no famous Japanese palaeontologists thought at that time.

Contribution ID: 889

The elaboration of the concept of Gondwana and the making of the scientific discourse for extractivism

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This paper analyses the relationship between the economic geological exploration of coal in the southern hemisphere continents and India in the late nineteenth century, and the elaboration of the concept of Gondwana in earth sciences. In particular, it refers to the distribution of the fossils of the *Glossopteris* flora, found in abundance in the coal reserves from these continents. This concept, created in the German-speaking central Europe, is a paradigmatic case for understanding the forging of the cosmopolitan science of Geology, which based on local studies and defined as the evolutionary science of the Earth, proposed unified theories of the globe, including evolutionary theories of human races and their migrations. The subsequent controversy leading to the elaboration of the continental drift theory, in the early twentieth century, were also mainly based on the correlations of the carboniferous deposits from the countries of the Global South. In this context, the geological/paleontological studies and exchanges about the fossil fuel deposits in Brazil, Argentina and South Africa were highlighted as part of the international debates over this theory, and the exchange of studies about the *Glossopteris* flora connected individuals and institutions involved in the exploration of minerals in Gondwana countries. This history sheds light on the processes of elaboration of a scientific discourse for imperial exploitation of the Global South and helps to better understand historical phenomena leading not only to global warming, resulting from fossil fuel exploitation, but also scientific theory of races, as an important instrument for this matter.

Contribution ID: 911

The Rearrangement of Scaling and Networking: Cosmographical Worldview Evolved into Geological Mapping

Toshihiro Yamada
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Following story may be just an episode of cartographical development, but it may, at the same time, explain how early modern Western scholars rearranged space distribution of various things into the time-related geological mapping. I will tell the process in four steps. First, Ptolemy's *Geography* was revived as *Cosmography* in the 15th century; *scala naturae* conception and the macro-micro cosmos correspondence were ways of explanation. Second, projection methodology connected threefold globe worlds represented by Apianus in 1524 i.e. eyeball, earth globe, and celestial globe; Kircher may succeeded the scheme as 'triad' of macro-geo-micro cosmos in 1641 with accumulation of specimens, materials, and information. Third, the cosmographical worldview was diffused into anti-Aristotle natural philosophies such as Gilbert of 1600 and Descartes of 1644; natural world became gradually independent from the interconnected world. Fourth, geometrically refined representation of subterranean world such as Steno of 1669 and Leibniz of c. 1691; conception of the history of nature and mining practices developed. This is a way, I think, in which the modern historical thinking emerged.

Symposium (Part 1/2) Women and academic careers in Central and Eastern Europe after the 2nd World War (1945–1968). S. held in honor of S. Štrbáňová (Com. on Wom. and Gender in Sci., Tech. and Med.) - ID 17

Contribution ID: 95

Female scientists at the newly established institutes of Slovene Academy of Sciences and Arts (1945-1960)

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After the communist takeover in 1945, Slovenia on the declarative level fundamentally changed its research policy and function of both main institutions (the University of Ljubljana and Slovene Academy of Sciences and Arts - SASA). It was planned that SASA to evolve into a research institution with scores of newly established institutes, whereas the university should be downgraded to primarily teaching institution. However, the research policy was modified, downsized, and partially reversed as well amid the paucity of researchers and economic unsuccess.
University professors were tasked with twofold tasks: to establish new institutes at SASA and up bring scores of top-notch researchers that supposed to be intuned with social-political order. Thus, newly created positions were once in a generation opportunity. Among female candidate two distinctive, age-related groups could be seen. The group of older (between 30 and 45 years of age) female researchers mostly adhered to traditional gender-associated stereotypes, which stipulated dedication to science even at the cost of private life. In contrast, the second group of emerging scientists was more engaged and intuned with concurrent views on social life as a private matter.
The paper will explore changes in opportunities for female scientists at SASA. Moreover, it will deal with if, how, to which extent scores of female scientists challenged institutional positions of power at the

newly established institutes? Have been any changes in perceptions of private life among researchers due to the integration of female scientists?

Contribution ID: 23

Female scientists and the Academy of Science in 1950s and 1960s

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My paper aims to uncover and research the changes in opportunities for female scientists afterwards the Communist takeover just a couple of years after the Second World War in Czechoslovakia. Czechoslovakia changed its former research policies, which broadened the possibilities for a post-World War II academic career. Recent research suggests that women had better professional recognition in new scientific disciplines and, to some extent, in institutional positions in times following the collapse of political order. The Communist's takeover and the desire to create new and numerous scientific foundations centered in the Academy of Sciences opened up new opportunities for young professionals. I would like to aim my research at the role of newly established Czechoslovak Academy of Sciences for female scientists and the opportunities to achieve a relevant scientific position at the academic institutes in the 1950s and the beginning of the 1960s.

Contribution ID: 26

Heading a communist hierarchy: The case of Savka Dabčević Kučar

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The academic path of Savka Dabčević Kučar, one of the first women to hold a PhD in economics in Yugoslavia, was always intertwined with politics. Although her exceptional intellect was recognized early on, her studies were postponed due to war. Though only 20 at the time she joined the Partisan resistance movement in Croatia and proceeded to study economics in Zagreb immediately after the war. She continued her studies in Leningrad in 1947-48. The Tito-Stalin split in 1948 made her return to Zagreb, along with the rest of the Yugoslav students. Her PhD topic was quite unique, since she chose to study J. M. Keynes in place of Marxist economists. Throughout the 1950s, she climbed the academic ladder and gained the title of Professor in 1960. In the following decade, she took all the most important political roles in Communist Croatia; in 1967 she was the prime minister of Croatia, and in 1969 she was a president of the Central Committee of the League of Communists of Croatia. In this presentation, after showing how her academic and political paths crossed in numerous ways, I will demonstrate how she used her expertise in economics in an attempt to decentralize and reform the Communist regime in Yugoslavia. Economic issues were regarded as highly political and nationally sensitive, as is evident from Tito's resolute termination of all the attempts to reform in the early 1970s. At this point Savka Dabčević Kučar was relieved of all academic and political positions that she previously held.

Contribution ID: 392

Female scientists in Berlin (East) at the University and in the Academy of Sciences (1946-1972)

Annette B. Vogt
MPI for The History of Science, Berlin, Germany

Female scientists in Berlin (East) at the University and in the Academy of Sciences (1946-1972)
Shortly after the capitulation of Nazi Germany on May 8, 1945 the academic system was re-organized under the rules of four Occupation powers in Germany and in the four sectors of Berlin respectively. The former Prussian Academy of Sciences was re-opened on July 1, 1946 as "Deutsche Akademie der Wissenschaften" in the Soviet sector as well as the Berlin University on January 29, 1946 (the later Humboldt University), the Technical University was re-opened on April 9, 1946 in Charlottenburg in the British sector, and finally, during the the air lift the Free University was established and opened on December 4, 1948 in the American sector. Under these circumstances the situation for female scientists was quite special and under permanent competition between the institutions and political systems.
Based on my research about scientists at the Berlin University (Vogt (2007, 2011, 2015)) and former émigrés who returned to Berlin-East and Berlin-West (Vogt in print), first I'll describe the situation for female scientists after the capitulation of Nazi Germany under new rules and rulers. Second, I'm discussing the conditions to be employed at the Berlin University, in the new research institutes of the Academy of Sciences, and at the Berlin University. Third, I'll illustrate these conditions by giving examples of female scientists who were working in Institutes of the Berlin University and in Institutes of the Academy of Sciences.

Symposium (5/7) 16th Annual Symposium of the Social History of Military Technology (ICOHTEC) - ID 128

Contribution ID: 149

From death rays to the Bolton Paul Defiant: a radical reinterpretation of interwar military technical development

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Historians writing on military technological development during the interwar period have all too often seen a logical progression as new weapon systems were introduced into the world's armed forces. The focus of the historiography has been on the successful integration of new or improved weapons into military organizations. For instance, much attention has been focussed on Germany's Panzer Divisions or the Royal Air Force's air defence system, without much consideration of the often illogical paths taken and mistakes made during the development of these highly successful applications of new technology to war. My argument is that technological change was occurring so quickly that it was often impossible for the technical and scientific staffs of the military to understand which new ideas would lead to effective new weapon systems and how these new weapon systems would be used in a future conflict. Historians have not spent enough time looking at how often militaries spent money on projects that were, at best,

remarkable flights of fantasy by well intentioned inventors. In some cases, money was spent on impossible project such as death rays, which were often outright fraud perpetrated by con artists. The inability to grasp the nature of future war led to some weapon systems, such as the Bolton Paul Defiant, to actually be built and see operational service during the early part of the Second World War. This paper will argue that there is a need to reconsider how we understand military technological and scientific developments during the interwar period

Contribution ID: 314

Giants in between. Ernst Mach's research within the framework of civil and military r&i of the Austrian-Hungarian Empire

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In recent and relevant historical studies Ernst Mach is charactericed to have been pacifist (see Blackmore (1972), Stadler (1982), Wolters (1987)). I am challenging this view by discussing his interactions with the Austrian Hungarian Army and propose rather to acknowledge that he seems to have been aware that it might be necessary to defend high civil standards through military action. Alongside this claim the delicate position that basic research holds within society is touched.
To develop my argument I am going to present and discuss primary sources, like letters between Ernst and Ludwig Mach and members of the Austrian-Hungarian Army (Ernst Mach Archiv, Deutsches Museum, München) as well as documents of the TMK, Technologisches Militärkomité (Österreichisches Staatsarchiv, Wien). Ernst Mach was engaged in developing peace and mutal respect by intellectual means which only can happen if civil space for discussion is not destroyed.

Contribution ID: 555

The photomosaic map, also known as the WWI "Flying Cinema"

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This paper explores photomosaic mapping techniques in WWI, focusing on the German system of photomapping territories by means of the military aerial camera *Reihenbildner*. This device took a rapid sequence of overlapping photographs that, once printed, needed to be rearranged in line to obtain an overall map of an area. Mapping kilometers of space through a series of photographs, this technology produced also stereoscopic pairs. Designed by the film tycoon Oskar Messter, the *Reihenbildner* was equipped with a standard cinema 35 mm film, following the same principle of a movie camera.
For this reason, in the last years of the conflict, this technology was propagandized in the German press as "*fliegende Kino*" (the flying cinema). The ability to observe landscapes through the moving and distant "aircraft's eye view" also proposed the idea of reassembling the vastness of space and the continuity of time in a single image.
By analyzing sources housed in German war archives, photo-optical artifacts collected at the Deutsches Museum, and photographs published in the WWI print media, this paper investigates both the military

relevance of the photomosaic in WWI and the impact caused by the spread of these photographic maps on German visual culture. WWI military photomapping inaugurated an important turning point in the aesthetic representation of the landscape. Moreover, the required production of aerial cinematographic film during warfare had positive consequences on the quality of film stock in the motion picture industry of Weimar Germany.

Symposium (Part 1/2) Scientific Instruments and Literature (Commission on Science and Literature) - ID 288

Contribution ID: 732

Early 70s, Nançay is the setting for a film and a novel

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Two stories take place in the Nançay radioastronomy station. This paper brings them together to show how each of them puts science and scientific instruments at the service of their plot.
In 1974, the editor and scriptwriter Yannick Bellon directed a film entitled "La femme de Jean". Her movie tells of Nadine's depression, left by Jean after eighteen years of living together, then her slow reconstruction, her search for work and the resumption of her studies in physics. Many scenes take place at the three sites of the Paris Observatory: in the Perrault building at Paris,on the terrace of the solar tower at the Meudon observatory, but also at the Nançay radioastronomy station where long shots reveal the differentradiotelescops.
In the 1971"Nançay R.A. 12 appelle Matt" spy novel, the French-speaking author François Chabrey instructs his male hero, an agent of the American secret services, to put an end to a communist listening network using the Nançay curious antennas, at the heart of the Cold War.
Narratives comparison shows that the choice of places(an astronomical observatory, a contemporary scientific instrumentation) is not innocent in the eye of the director to show female emancipation through a sensitive and militant vision of research and science; even if in thefilm neither work carried out, the instruments nor the mathematical tools used are named or explained. On the other hand, the novel, provides extensive technical details on the instruments yet making actual scienceactivities narratively useless.

Contribution ID: 806

The Expo 58 as a global event for the development of scientific instruments in the Cold War and its use in spy novels.

GEORGE VLAHAKIS
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The 1958 World's Fair in Brussels (known also as Expo 58) marked the middle of the 20th century in several aspects. It was visited by more than forty million people and many countries participated with huge and impressive pavilions. As the Cold War was in almost its peak the capitalist West and the

communist East wanted to prove that they were the Avant-guard in science and technology development.
The milestone of the fair was the Atomium, a gigantic construction resembling the unit cell of an iron crystal. The darkest event was the organization of the human zoo, a village showing life in an African village. This racist approach was not yet considered a terrible moment for European civilization by the most imperialistic countries.
Many of the superpowers of the era, presented there a number of instruments, mostly related to their progress in atomic and nuclear energy and especially in the peaceful applications of these energies.
The present paper will discuss the scientific instruments presented in the fair as well as their use in spies' novels related with cold War and Expo58.

Symposium (Part 3/4) The materiality of knowledge circulation between China and Europe: physical formats, epistemic genres, spatial localities (16th-18th century) (ISHEASTM) - ID 33

Contribution ID: 52

From Text to Map: Maps and Geographies as Catalysts for Cross-cultural Contact in Late Ming China

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The vigor of commercial life and book culture in Ming China during the sixteenth and early seventeenth centuries enabled the proliferation of imperially commissioned, privately composed, and commercially produced empire-wide maps and comprehensive geographies (known in the literature as *zongzhi* 總志). Perhaps the best-known and most authoritative of these was the *Enlarged Territorial Maps* (*Guang yu tu* 廣輿圖) by Luo Hongxian (羅洪先, 1504-1564). Effectively an atlas rather than a gazetteer, Luo's work is widely understood as the source material of the maps and atlases of China produced by European missionaries. Starting from a new typology of comprehensive works of geography produced during the Ming, this paper investigates which Chinese-language maps and geographies these European Jesuits really relied on and how they shaped how the Chinese Empire was understood by European audiences in the seventeenth and eighteenth centuries.

Contribution ID: 59

From maps to texts: knowledge transition in early Jesuit writings

Anna Strob
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Maps played an important role in the early Jesuit mission in 17th-century China. They were important tools for communication and conversion. Analyzing them gives us an idea of what was given priority in the process of cross-cultural knowledge transmission and cultural accommodation. The most prominent map in this context is the *Kunyu wanguo quantu* 坤輿萬國全圖 (Complete Geographical Map of the

Myriad Countries of the World, 1602) designed and annotated by Matteo Ricci, one of the mission's most influential figures. This talk analyses the geographical depictions, the innovative approach to accommodate to the Chinese interest in scientific detail on *all under heaven*, and the advancement of European mapmaking displayed on Ricci's word map. Based on this analysis of the map's legends and carefully chosen illustrations, its use in Alfonso Vagnone's treatise on the investigation of celestial phenomena (*Kongji gezhi* 空際格致, c. 1633) will be highlighted to trace the continuation and consistency of knowledge transmitted in early Jesuit writings. It will be shown that this shift in material format – that is from a visual depiction of space to a textual description of the composition of the world – allowed an extension of the main ideas and concepts paramount to establishing a coherent and consistent worldview and terminology within the Jesuit works.

Contribution ID: 63
Monuments, hermeneutics, or astronomy? China and the invention of 'philosophical history'

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This paper argues that the characteristically Chinese use of astronomy for the purposes of history and timekeeping was appropriated, through Martino Martini and a few other missionary go-betweens, by European scholars. In turn, it suggests that Martini's Sinicae Historiae Decas Prima (1658) played an important role in the ostensible secularisation of 'philosophical history' frequently associated with the French Enlightenment. It propounds that although Martini's use of astronomical data in historical scholarship was not particularly innovative—Scaliger had used astronomical records to reconstruct historical events since the late sixteenth century—the missionary's work catalysed a more substantial 'astronomical turn' in the practice of history, prompting influential Lumières like Voltaire to adopt celestial records, which supplanted material monuments and scriptural hermeneutics, as the most credible basis for historical scholarship. The paper explores history's 'astronomical turn' in light of Martini's and Schall's relationship to the Manchus. It argues that it was both in the missionaries' and the Manchus' interests to form a somewhat unorthodox coalition centred around astronomy. Jesuit astronomical expertise offered the Manchus a resource to legitimise their rule according to Chinese political cosmology and in turn, the Manchus offered the Jesuits a powerful role in the Imperial Astronomical Bureau at court. Historiographically, the episode examined in this paper indicates a need to revisit the roots of the ostensible 'secularisation' of history associated with the Enlightenment, many of which, I contend, need to be relocated outside Europe.

Symposium Astronomical tables and canons in the Alfonsine tradition - ID 115

Contribution ID: 597
Building new astronomical tools: a mise en perspective of the equation of time in Lewis of Caerleon's astronomical works

Laure Miolo
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A native from Wales, Lewis of Caerleon was educated in Cambridge (Bachelor of Medicine in 1465-1466) and became a Doctor of Medicine in 1481. He served as the physician of Elizabeth Woodville, Margaret of Beaufort and her son Henry (the future king Henry VII) during the troubled times of the War of the Roses. Faithful to the Lancastrian faction, he was incarcerated in the Tower of London by Richard III in 1485. In parallel with his career as a court physician, Lewis of Caerleon devoted a part of his life to the production of astronomical materials. Although his scientific production is mainly related to eclipse predictions, he also produced different tables and canons in the field of trigonometry and spherical astronomy, but also for the equation of time. During three decisive moments of his career, he created new sets of tables along with canons. The final version of these works was likely intended to patrons or institutions as some extant manuscripts testify. Although he innovated in creating new tools, the physician relied on important earlier sources and authorities. Thankfully, several extant manuscripts allow to precisely retrace the elaboration of his astronomical production, from the earliest drafts to the presentation copies of his works. Overall, these sources provide an exceptional case study of a late medieval astronomer at work, and I will explore in my talk the development of Lewis of Caerleon's astronomical work to situate more clearly his new tables of equation of time – including the canons associated with them – within his astronomical agenda.

Contribution ID: 598
The hierarchical structure of tables: Lewis of Caerleon on the equation of time

Stefan Zieme
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Practice in the astral sciences rested on tables. From the fourteenth to the sixteenth century, tables of the Alfonsine corpus were predominantly used in Latin Europe and circulated widely. Some sets of the Alfonsine corpus were rearranged or certain quantities precalculated but, different to Islamicate astronomy, the base material remained unchanged. An exception to this are tables of oblique ascensions and the equation of time, which needed to be newly computed due to the dissemination of the Alfonsine material through space and time: When sets of tables traveled to northern latitudes, new tables of oblique ascension for these latitudes needed to be computed that were not part of the previous corpus. Likewise, with the passage of centuries new tables for the equation of time needed to be computed due to the change of the solar apogee. How these tables where newly computed and, thus, the astronomical problems conceived of is mostly unknown.
In this talk I will focus on the equation of time that was newly computed by Lewis of Caerleon in 1485. By analyzing his historical practice I will show that Lewis' conception of the equation of time is very different from the modern perception of the mathematical problem. His structuring of the computational task derived from the tables he was using. For Lewis tables formed an hierarchical structure according to which he organized the problem. Rather than being passive tools, shaped through astronomical and mathematical inquiry, tables acted upon the way of thought and practice.

Contribution ID: 617
Planetary latitudes tables in Conrad Heingarter's astronomical manuscripts

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SYRTE - Observatoire de Paris - PSL, Paris, France

Conrad Heingarter (fl. lat. 15th c.) was a court physician and a renowned astrologer to the Duke Jean II of Bourbon. As an astrologer, he had a keen interest in astronomical material and wrote several treatises of astrology. We have several manuscripts which belonged to him at our disposal, especially BnF Latin 7295A, his practitioner toolbox and BnF Lat. 7432, an ornate presentation manuscript. Both of those manuscripts include planetary latitude tables. BnF Lat. 7295A, in particular, displays three sets of latitude tables in the context of : the *Tabule Regis Alfonsi*, the Oxford Tables of 1348 and the tables of John of Lignères for 1322. In one case he even glued an additional folio to a quire in order to have the table in a specific place in the manuscript. This special interest of a fifteenth century astrologer in latitude tables will be discussed. It also provides an occasion to present and analyse the tabular computational tools available in 15th century Europe to tackle the issue of planetary latitude. The theoretical backbone remain ptolemaic, but after diverse attempts in this direction by 14th century astronomers, William Batecombe, an English astrologer and mathematician who was a magister at the University of Oxford, composed circa 1348 a set of double argument latitude tables which proved successful across Europe well into the 15th century. The Oxford tables for latitude will be a special focus of the talk and new results on their underlying computation scenario will be presented.

Contribution ID: 639

Conrad Heingartner's notes on canons for finding planetary latitudes

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The career of Conrad Heingartner (lat. 15th c.) could, in many ways, be interpreted as the pinnacle of what one could hope for in the pursuit of the sciences during the fifteenth century. Trained as he was at the University of Paris, Heingartner would go on to serve as court physician and astrologer to Duke Jean II of Bourbon (1426-1488), as well as an advisor and diplomat for Kings Louis XI (1423-1483) and Charles VIII (1470-1498) of France. What is more, in Heingartner's case, historians are also fortunate to have several manuscripts of his personal library preserved. These include workbooks, which yield insights into which authorities most influenced, and what subjects most preoccupied, Heingartner as he honed his skills as a practicing astrologer and physician. In one of these manuscripts, BnF MS Latin 7295A, Heingartner took many marginal notes on John of Saxony (1297-1335) and John of Lignères' (1320s-1340s) astronomical canons for operating the Alfonsine Tables. He also punctuated the text with a rubricated stylus at certain points that seem to have garnered his particular interest. One such place is the section of John of Lignères' canons treating planetary latitudes – an element of medieval astronomical theory that is often presumed to have been neglected by practitioners of astrology. In this paper, I will compare the annotated canons of MS 7295A with a recently discovered treatise on latitude theory that he wrote in a later – and highly ornate – manuscript, BnF Lat. 7432, dedicated to his patron.

Symposium (Part 2/2) New perspectives: differentiating cultures in ancient mathematics (IASCUD) - ID 529

Contribution ID: 635

Using the square or using the circle? Different proofs on the "Broken Bamboo" Problem

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Many parallel problems are found in ancient Chinese and Sanskrit mathematical texts. One typical case of them is the so-called "Broken Bamboo" or "Sinking Lotus" problems. The descriptions of the problems and the rules attached to them are extremely similar in Chinese and Sanskrit sources. This has been well noted in the historiography, and it has been assumed that Chinese and Sanskrit sources may have shared similar circulating mathematical practices. However, if we check the verifications/proofs of the algorithms carefully, we find that not all proceed in the same way. Liu Hui, the 3rd century commentator of the *Nine Chapters*, uses a right triangle which he then changes to a "square". Bhāskara I, the 7th century commentator of the *Āryabhaṭīya*, explained the rule by using the relationships of arc, arrow and radius in "one's own circle". Moreover, later the same problems and rules are found in other Sanskrit works. It is interesting that the 9th century Pṛthūdaka explains the rule in a way similar to Bhāskara I while the 12th century Bhāskara II uses the three sides of the right triangle, which "seems like" Liu Hui. In the presentation, we re-examine a tradition which considers a culture of Chinese and Indian mathematics, to rather focus on the different practices shared or not by different .

Contribution ID: 692

Mathematical cultures according to observers and to actors: The historiography of number systems and arithmetic

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The historiography of number systems and arithmetic has been for its greatest part organized according to nations and linguistic groups. This holds true, for example, for Geneviève Guitel's *Histoire Comparée des Numérations Ecrites* (1975), despite the fact that her focus lies elsewhere: she aims to show that all written number systems can be described and classified according to a few general principles. By concentrating on the example of Guitel (1975), this talk intends to identify recurring problems in the historiography of number systems that have more broadly underpinned the view that national or linguistic groups constituted the relevant frame of analysis. By contrast to observers' approach to number systems, such as Guitel's, I will show that this is not the way in which, in his *Kitab al-Fusul fi al-Hisab al-Hindi* (Saidan 1978), the 10th century practitioner of mathematics, al-Uqlidisi perceived the divide between different number systems and their collectives of users. Drawing on his account, the talk suggests that we derive a research program about number systems and arithmetic that might allow us to highlight the different cultures of computation that coexisted in ancient societies, as well probably as in modern ones.

References

Guitel, Geneviève, 1975. *Histoire Comparée des Numérations Ecrites* (Paris: Flammarion, 1975).

Saidan, Ahmad S., 1978. *The Arithmetic of al-Uqlidisi. The Story of Hindu-Arabic Arithmetic as told in* Kitab al-Fusul fi al-Hisab al-Hindi*, by Abu al-Hasan Ahmad ibn Ibrahim al-Uqlidisi, written in Damascus in the year 341 (A.D. 952/3)* (Dordrecht: D. Reidel, 1978).

Contribution ID: 833

19th Century French Scholars' observations on the Chinese abacus and its cultural background

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In the 19th century, French sinologists Paul Perny, Terrien de Lacouperie, Arnold Vissière, and orientalist Léon Rodet, investigated the notation and operation for the Chinese abacus and made some observations. They praised the Chinese abacus as an ingenious calculating device which had the merit of allowing practitioners to operate quickly in comparison to the pre-modern European abacus. However, they also suggested that the slower calculating instruments in Europe facilitated the development or adoption of a set of notations for calculating and were more useful for arithmetic researches and demonstrations. In this paper, we are examining how their various mathematical cultures, anchored in various 19th century's contexts – if we define mathematical culture as the ways of thinking and doing mathematics and the understanding of the nature of mathematics (or arithmetic), especially its preferences in evaluating mathematics -- affected their observations. We will also discuss briefly how historians re-considered the textual evidence about ancient mathematics, that is, how they approached the influence of a material instrument -- the abacus, in this case -- on a mathematical textual practice, as well as the thoughts connecting to it.

Contribution ID: 834

19th Century French Scholars' observations on the Chinese abacus and its cultural background

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In the 19th century, French sinologists Paul Perny, Terrien de Lacouperie, Arnold Vissière, and orientalist Léon Rodet, investigated the notation and operation for the Chinese abacus and made some observations. They praised the Chinese abacus as an ingenious calculating device which had the merit of allowing practitioners to operate quickly in comparison to the pre-modern European abacus. However, they also suggested that the slower calculating instruments in Europe facilitated the development or adoption of a set of notations for calculating and were more useful for arithmetic researches and demonstrations. In this paper, we are examining how their various mathematical cultures, anchored in various 19th century's contexts – if we define mathematical culture as the ways of thinking and doing mathematics and the understanding of the nature of mathematics (or arithmetic), especially its preferences in evaluating mathematics -- affected their observations. We will also discuss briefly how historians re-considered the textual evidence about ancient mathematics, that is, how they approached the influence of a material instrument -- the abacus, in this case -- on a mathematical textual practice, as well as the thoughts connecting to it.

Contribution ID: 874

How many mathematical cultures are there in the works of Fibonacci? An alternative perspective on differentiating cultures in mathematical practices

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Fibonacci's works, especially his *Liber Abaci*, inherited mathematical knowledge from different traditions. Although in most cases the source could not be identified as specific books, our forerunners (Folkerts, Miura, Høyrup, etc.) have convincingly demonstrated the connections between certain parts in the work of *Fibonacci* to different cultures in a sense that is similar to civilizations: Greek, Indian, Arabic, Byzantine, etc. However, in the present paper, mathematical culture is conceived as a way of doing mathematics. Taking propositions from Fibonacci's works as examples, I will not only enumerate the different ways betrayed by the texts from different sources but also analyze his various treatments on particular same (would-be from the viewpoint of modern mathematics) pieces of mathematical knowledge. Furthermore, some conjectures will be made, on the one hand, concerning the milieus for the different ways of practice we saw, and on the other hand, concerning the groups of addressees that Fibonacci was aiming at with different types of presentations.

Session VI (Part 3/3) - Academies, Societies, Laboratories and other Institutions - Laboratories

Contribution ID: 1104

A glance at Emil Artin's mathematical laboratory – his letters to his doctoral father Gustav Herglotz

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Emil Artin (1898-1962) is renowned for his contributions to algebra and number theory and also for his style of mathematical exposition. In particular, the title page of Bartel Leendert van der Waerden's "(Moderne) Algebra" documents that Artin's lectures on algebra at Hamburg were one of the two templates for this classic.
As to the influence on Artin, it is often said that he was one of Emmy Noether's collaborators if not her student. But one has to be aware of the fact that he took his doctoral degree at Leipzig under the supervision of Gustav Herglotz (1881-1953) who, according to Serge Lang and John T. Tate, "was the only person whom Artin recognized as having been his 'teacher'".
This contribution studies Artin's writings to Herglotz which are kept in the latter's estate at Göttingen (whereas the writings from Herglotz to Artin got lost). They comprise of 13 letters and 1 postcard and date form the years 1920 to 1931, i.e., the time from the student Artin at Leipzig to the young "Ordinarius" (= full professor) at Hamburg. Therefore, one can get a look on him at a rather early stage of his career, mainly in the years 1920 to 1924. The contents of the writings are predominantly mathematical, including questions on the aesthetics of presentation, but they also reveal the contacts that Artin really had during his postdoc year at Göttingen.

Contribution ID: 1197
Visiting and working with a giant: Cohips and acknowledgements at the Zoophysiological Laboratory of August Krogh

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The Zoophysiological Laboratory at the University of Copenhagen was a hub for international scientific exchange in the first half of the 20th century. In the center of the laboratory was August Krogh, the founder and director. From the laboratory's foundation in 1911 until 1945, when August Krogh retired as professor and laboratory director, 79 different scientists authored 327 scientific papers based on research done at the laboratory. The many scientists at the laboratory included both scientific giants-to-be and scientific dwarves with minor achievements or forgotten historic impacts. With Krogh authoring or co-authoring one third of the papers, analyzing the cohips and acknowledgements in the Collected Papers of the Zoophysiological Laboratory gives a great insight into how a giant in science such as August Krogh can affect the field's future hierarchy.
In this paper, I study how Krogh as a giant in physiology influenced the careers of his junior colleagues at the laboratory. I map the (co)hips and acknowledgements of assistance at the Zoophysiological Laboratory. Further, I study what the acknowledgements tell us about how Krogh influenced the research ideas of his mentees, while noting that acknowledgements may only show the tip of the iceberg of the exchange of ideas. I then look for relations between this information and the future careers of the scientists working there. In essence, I ask the question: Were giants-to-be more likely to author alone with their own ideas while at the laboratory, while others co-authored with Krogh? Or was it the other way around?

E-posters (Part 3/3)

Contribution ID: 1256
E-POSTER (De)colonizing climate change

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Colonization has indisputable social and economic detriments that persist even today. This is visible especially in the abilities of post-colonial developing economies to manage and mitigate the effects of climate change at the cost of economic development. The environmental efficiency of production in the Indian subcontinent and Sub-Saharan Africa have thus been impaired by colonization in contrast to Western Europe and Northern America. Currently developed economies, thus, have more developed institutions for scientific research and development, higher flexibility in their industries and labour force to adapt to the requirements of a green economy, greater access to technology and more wealth, making said technologies more affordable. In addition, these economies developed using polluting industrial techniques in an era where climate change was not given much importance. Developing economies do not have this opportunity as the cost of controlling environmental effects and the indirect cost due to climate change, both, are higher in them.

Relevant solutions need to be multi-dimensional, accounting for the economic, social, cultural, and ecological diversity of various regions of the world. Conventional solutions including technological, technical, and monetary aid by developed economies and necessary government regulations are a requisite. Improving literacy, in particular climate literacy, can also reduce emissions and harmful practices in both developed and developing economies. Additionally, integrating tribal philosophies and practices with green technologies can develop more sustainable forms of agriculture or other production, due to their emphasis on attaining harmony with nature while keeping in mind demands of increasing human population.

Contribution ID: 1257

E-POSTER How to teach experiments in times of distance learning

Susanne Gruber
Association for Research in Commodity Sciences an Applied Sciences, Obersorf, Austria

Learning with hands-on teaching has always been achieved the best learning outcomes. In times of Distance learning, science teachers tried to bring experiments into the households to enable students and their families science experience.
Especially in secondary vocational schools there is less time for practical lessons. Times of distance learning opens up new opportunities for practical teaching. Experiments must be organised with simple instruments and less material, that can be run at home.
Experiments can be reorganised, so that even microorganisms could be grown, or DNA can be extracted from fruits at home. Lessons must contain the following:

- Precise description by the teacher, given in video, in conference or in texts,
- Very precise safety instructions,
- Use of less materials and household appliances (such as candles, knives, spoons, glasses, vinegar, nutritional oil, salt, sugar, flour, rice, milk, spirit, food colourings),
- Complete documentation in reports, including text and photos,
- Debriefing via video conference and written feedback;

Teachers are not allowed to assume adult supervision. Precise safety instructions are the most important part of experiments at home, especially when students work with water maybe nearby their computers, with heat or open fire. It is important to demand reports including photos to avoid copy and paste sessions.
During the first 2 month of distance learning, success of the students was increased by 20 to 30 % compared to previous years. They had to study the experiments more intensively because of the preparation.
Worksheets can be requested from the autor.

Contribution ID: 1265

E-POSTER Pierre Duhem Forgotten? A Reply from an Epistemological Point of View

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In the history of science the French physicist, historian and philosopher Pierre Duhem (Paris 1861-Cabrespine 1916) has not the right relevance that can be bestowed to his genius. Professor of physics to University of Bordeaux, engaged in the thermodynamics studies, Duhem is an eminent representative of an age that is caractherized by a critical reflection about the foundation, the value of scientific knowledge, at the end of XIX Century.
In his biography the difficulties concerning his presence in the French academic world are evident. Duhem renounce to a chair of historian of science in Paris because he wants be just a theoretical physicist.
My contribution is consecrated here to see the important role of Duhem in the epistemological debate. History of science and epistemology are connected strictly in Duhem'works, and I hope to emphasize the presence of this geant of science in the XX Century.

Contribution ID: 1237
E-POSTER Early history and development of high voltage electron microscope in Japan

Kotaro Kuroda
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Commercial high voltage electron microscopes (HVEMs) were developed in Japan in the mid-1960s. What was going on towards this development? The operating voltage of commercially available electron microscopes was in the range 40-120 kV until mid-1960s. Some prototypes were built to operate at 300-400 kV in 1950s and those included most of the features of HVEM. The two Japanese developments were both examples of academic-industrial cooperation. Sakaki et al. at Nagoya University had in conjunction with Hitachi developed a 300 kV microscope. Kobayashi et al. at Kyoto University had in conjunction with Shimadzu developed a 350 kV microscope. Microscopes for 500 and 650 kV soon appeared in Japan, and in 1966-67 the ceiling was pushed to 1 MV, mainly by competition between the two chief makers, Hitachi and JEOL. The Japanese had gone ahead with their developments of HVEM, largely because their instrument manufacturers had not been influenced by the pessimistic findings of the Western electron microscopists that the effective penetration would improve less rapidly than in proportion to operating voltage by theoretical studies. Although electron microscopists in the West were still interested in higher voltages, no manufacturer was interested, since at the time there was a market boom in conventional electron microscopes, and they felt no need to develop what appeared to be an unprofitable line in HVEM.

Contribution ID: 1270
E-POSTER Ancient and Early Modern Geometrical Optics

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Modern geometrical optics builds on approximations of the series of *sinx* function. It was Euler who in his 1748 *Introductio in analysin infnitorum* expanded *sinx* into series and then introduced this idea into optics. Till the end of the 17th century, geometrical optics combined simple physical rules and

techniques of elementary geometry, namely Euclid's theory of similar figures and Appolonius results concerning cone sections, therefore it could be an engaging course for secondary schools students.
In his 1637 *Optics*, Descartes proved two intriguing claims on hyperboloidal and ellipsoidal refracting surfaces (*Dioptrique*, pp. 92-92, 103-105). Further, he applied these results to determine refraction index of a medium (*Dioptrique*, pp. 135-140).
(1) We present Descartes' theorems against the background of geometrical optics as it was developed till the end of the 17th century. To this end, we introduce Euclid's theory of similar figures, specifically the relationship between similar triangles in terms of the ratio scale. Then we discuss Appolonius theorems concerning tangent lines to conic sections (Heath, 1896, propositions III.48, 52).
(2) We discus Descartes' derivation of the law of refraction (*Dioptrique*, pp. 17-22) and the role of the concept of infinity in his argument.
(3) Finally, we present Euclid's theory of proportion as developed in book V of the *Elements* as the basic technique employed in geometrical optics.
References
1. Burton, The Optics of Euclid, *Journal of the Optical Society of America*, 35(1945).
2. Descartes, *Discours de la Méthode ....* . Lejda 1637.

Contribution ID: 1272

E-POSTER European scientists-researchers of the Caucasus (XVIII-XIX centuries)

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The XVIII century was the beginning of a systematic study of the Caucasus. An important role in organizing research activities in this area belongs to the St. Petersburg Academy of Sciences, which was entrusted by the government of the Russian Empire with an important cultural and historical mission. The state was interested in obtaining detailed information about the nature and population of the Caucasus. Academic expeditions of the second half of the 18th century played a significant role in this. with the participation of prominent European scientists (Pallas, Guldenstedt, Gmelin, Falk, etc.) with a wide scientific outlook, diverse interests and research experience. Detailed descriptions of the nature and population of individual territories of the Caucasus, obtained during expeditions, are still have scientific value and remain relevant. Thus, thanks to the high level of development of European science, Russia received qualified personnel to organize in the second half of the 18th century large-scale scientific researches of little-studied territories of the Empire. In the 20th century the number of researchers (travelers) of the Caucasus has increased significantly. Their notes contained strategic, geographic and statistical descriptions of individual parts of the Caucasus. Among those who made such notes were the military, writers, poets, historians, ethnographers and just travelers: Beaujour Lcuis-Felix (French diplomat), Belanger Charles (French naturalist), Ehrenberg Christian Gottfried (German naturalist, Alexandre Dumas, etc. The Caucasus, with its majestic beauty and rich nature, amazed all travelers.

Contribution ID: 1274

E-POSTER and patentees in aeronautics and aviation, 1880-1914

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In this paper we characterize the population of people who published or patented about aeronautics and aviation in the period before and after the invention of the airplane. We have a database of information on over 8000 patents and 20,000 publications related to aeronautics and aviation in this time period, from many countries and directed toward many technologies.
We examine the population of experimental scientists and tinkerers who created these works. For hundreds of these, we have basic information about their demographics nationality, and prior education or work experience. We analyze how many times each person patented in this field, and the overlap with those who published in journals. We examine especially those who were active in a society or helped start a company.
Preliminary information shows the people active in early aeronautics had a variety of occupations. A plurality were engineers. The early airplane companies were founded mainly not by airplane tinkerers but by successful manufacturers branching in from other fields. The problem of creating a flying machine was of broad interest, and we can show that many people who took an interest in were successful in other fields.
The database is public at http://econterms.net/aero. Patent data comes mainly from patent offices, especially from a collection of the European Patent Office. The bibliography of aeronautics comes mainly from Brockett (1910, 1921). Many other sources had valuable information and are cited on the web site.

Contribution ID: 1282

E-POSTER Michelangelo, Copernicus and the Sistine Chapel: the Last Judgment Decoded

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It has long been recognized that in Michelangelo's fresco of the Last Judgment (painted 1536-1541) Christ is depicted as a classical, beardless 'Apollonian' sun-god in the centre of a 'cosmic' circular design. The possible influence of Copernicus's theory of heliocentricity on Michelangelo's fresco has been considered by art historians, but consistently rejected on the grounds that Michelangelo's fresco was finished in 1541, two years before the publication of Copernicus's book, Revolutions, in 1543. The idea has thus always been dismissed without full exploration and consideration. Art historians have seemed hesitant to delve into astronomical texts, and astronomers are perhaps less familiar with Renaissance frescoes. It can, however, indeed be argued that Copernican heliocentricity is reflected in Michelangelo's fresco – with the knowledge, consent and approval of the two Popes concerned.
Dr Valerie Shrimplin has lectured extensively on Byzantine, Medieval and Renaissance Art and Architecture and published widely on the influence of astronomy and cosmology on art and architecture (including her PhD on the influence of Copernican heliocentricity on Michelangelo's frescoes in the Sistine Chapel). See: www.valerieshrimplin.com

Symposium (Part 7/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 211

Contribution ID: 289

The Very First Use of Sextants and Octants in Turkish Marine in the 18th and 19th Centuries

Hakan SEMİZ
History of Science, SIC 2021, İstanbul-Beykoz, Turkey

In the second half of the 18th century, Turkish marine increased efforts to determine latitude and longitude at sea. This is arguably due to the introduction of relatively new marine instruments in the Ottoman navy: the sextant and octant, that allowed easier and more accurate measurements than before to determine latitude. In Europe, sextants and octants gradually replaced commonly used instruments such as mariner's astrolabes and Davis quadrants by the end of the 18th century. In Ottoman Turkey, these instruments were introduced by Europeans who worked in Istanbul. The Baron de Tott (1733-1793), in particular, was essential in this process. He was an aristocratic French engineer of Hungarian descent. He contributed to the 18th century reform movements of the Ottoman Empire both through his engineering and lecturing skills. He stayed in Istanbul on two different occasions, from 1755 to 1763 and from 1771 to 1776. During his second sojourn in Turkey, he also established a school of engineering (Handasakhāna). The records show that he ordered the purchase of twelve marine octants and a number of other various scientific instruments for this school. Although there is no mention of a sextant, several sources indicate that he also taught his students how to use a sextant and other navigation instruments. The aim of this talk is to provide details of the very first records on the use of sextants and octants in Ottoman Turkey and discuss their application in teaching, by using Baron de Tott as the main example.

Contribution ID: 479

Scale for the Setting: The Tension Between Accuracy and Ease of Use in Exploration c1830-1850

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This paper will describe the emerging European traveller from the 1830s, and their demands for instruments that are convenient without losing the inevitable advantages of larger scales (in both the particular and general sense). It will document the arguements , principally at the Royal Geographical Society in London, over the introduction of box sextants, aneroid barometers, chronometer watches and prismatic compasses which ocurred at the time. It will argue that , as in the case of the microscope in the early 18th century, a loss of precision was accompanied by a significant increase in user numbers and the number of instruments produced. The paper will argue that the activities of users normally acted to change the design of instruments, but occassionally, as in the filar magnetometer, a radival change in a measuring instrument could introduce new interests on the part of the users.

Contribution ID: 432

London as a stopover for Russian circumnavigations in the first half of the 19th century

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London played a significant role in the preparations for Russian circumnavigations in the first half of the 19th century. Since the Baltic German explorer Adam Johann von Krusenstern had established good maritime connections with the British, London became the most important stop for acquiring instruments for the Russian voyages. Although Krusenstern himself did not visit London during his circumnavigation (1803–1806), several later Russian expeditions did. Most of them anchored in Portsmouth but travelled to London to acquire instruments. Fabian Gottlieb von Bellingshausen (1819–1821), Otto von Kotzebue (1823–1826) and Friedrich Benjamin von Lütke (1826–1829) all undertook the journey to London in person to buy instruments and to meet important British scientific and naval figures.
This presentation aims to look in detail at the dealings of the aforementioned Baltic German explorers in London in the context of the process of acquiring navigational instruments. How and with whose help did they buy the best equipment for the circumnavigations, and which instruments did they get? It is also interesting to see what role the Russian embassy in London and ambassador Christoph Heinrich von Lieven played in this process, as well as the roles played by important scientific institutions in London such as the Royal Observatory in Greenwich.
This paper draws upon new information from Russian archival sources in the Russian State Archive of the Navy in St. Petersburg and sheds more light on the preparations of the Russian voyages.

Contribution ID: 275

Britain's worldwide seismograph network and its private funders, 1896–1932

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Beginning in 1896, a committee of the British Association for the Advancement of Science established an international network of seismographs. German astronomer Ernst von Rebeur-Paschwitz had recently demonstrated that faint signals from distant earthquakes could be detected anywhere on the earth's surface with suitably sensitive instruments. The BAAS committee hoped that systematic, coordinated observations of earthquake waves would reveal patterns of earthquake distribution, and generate knowledge about the composition and structure of the earth.
With limited state funding available for such projects in Britain, the committee drew heavily upon a suite of private funders to execute their plans. Until his death in 1913, Britain's foremost seismologist, John Milne, was particularly resourceful in cultivating relationships with individuals and businesses. To secure support for the purchase of instruments and construction and equipping of observatories, Milne and the committee articulated the practical and economic benefits seismology and seismographs could bring.
This paper explores who these funders were, and their reasons for supporting the enterprise. They included telegraph cable engineers, interested in insights into submarine cable breakages; shipbuilders

with shared interests in vibration; and even newspapers, hoping for the scoop on earthquakes around the world. Although traditional scholarship holds that state funding for British science began to prevail over *laissez-faire* from the late nineteenth-century, this was far from the case for British seismology, which was reliant upon private funds well into the twentieth century.

Symposium (Part 2/3) Great to small: spatial and temporal scales in the history of the geosciences (INHIGEO) (with IUGS) - ID 506

Contribution ID: 656

Henry Thomas De la Beche's (1796-1855) Duria antiquior: temporal visualization within the golden age of geology (1788-1840)

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In 1830, Henry De la Beche (1796-1855) published *Duria antiquior*. Based on Lias fossils near Lyme Regis, England, the illustration was the first paleoecological reconstruction and aquarium viewpoint scene published. *Duria antiquior* provides a portal for temporal understanding during the Golden Age of Geology.
Early foundations for geologic time reconstruction are attributed to Nicholas Steno who established a temporal framework for rocks through superposition. Over a century later, James Hutton (1726-1797) developed a definitive lens through which ordered rock layers could be examined—and the considerable time required for erosion, weathering, deposition, and lithification.
Fossils provided another lens to construct Deep Time. William Smith recognized predictable and ordered fossil assemblages, though not everyone acknowledged that fossils represented extinct organisms: Charles Lyell promoted Huttonian uniform processes but erroneously thought fossil organisms could reappear. Conversely, De la Beche recognized extinction and time's directional arrow, but rallied against Lyell's theory of uniform processes.
Therefore, De la Beche envisioned *Duria antiquior* with a mindset that opposed uniformitarianism but acknowledged fossils as organisms long departed from the planet. His illustration likely was inspired by Conybeare's plesiosaur descriptions and Buckland's vivid descriptions of primeval Lyme Regis. However, *Duria* was a snapshot of re-imagined Jurassic creatures without context or documentation of time progression. Buckland encouraged him to produce other scenes and develop a temporal series, but De la Beche did not follow through. The Deep Time progression would not be realized until John Emslie's (1849) illustration from Silurian through Tertiary, representing life before a biblical deluge.

Contribution ID: 660

Small pieces of rocks, shells, sand grains and mineral nodules: islands and ocean as geological strategic projects in Brazil

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Small pieces of rocks, shells, sand grains and today mineral nodules from Brazilian islands and areas of the Atlantic Ocean have been central objects for local and global projects aimed at understanding the broad spatial and temporal scales of the geological history of the continent. Besides their political-strategic locations, Brazilian islands had caught the attention of conquerors and naturalists. They were mandatory stops for Global Deep-Sea Expeditions. All the main Brazilian institutions in the 19th and 20th centuries turned their attention to the geology of the islands, coastal regions, and ocean studies. Those small objects lent support to theories about the continental or oceanic constitutions of these islands, which became part of local and world geological maps, through translation operations that transform isolated samples into regional, global constructions. As many of the geological features are not mobile given their space-time dimensions, it is precisely those correlations that allow their mobility and circulation. Monazite sands, from beaches, subject of international smuggling, attracted the interest of geological projects at National Research Council, in the 1950s, vital for the Brazilian nuclear industry. Today, mineral nodules samples, from the deep-sea are central to the discussions not only of the possible continental origins of the Rio Grande Rise in the southern Atlantic, and mineral exploration of the oceans. This work explores how individual researchers and institutions have dealt with the spatial and temporal scales of locally situated geological processes related to islands and marine environments in their broad strategic projects in Brazil.

Contribution ID: 812

Scale in the history of geology

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Spatial scales in the mind: effects of ideology on geology in Germany 1933 to 1945

It is not just natural processes, which unfold over wide ranges of spatial and temporal scales. Scientists' perspective of processes they study may vary as well in terms of historical context and personal experience.
Geology by definition has a global perspective. Historically, however, the scientists' outlook has always been affected, e.g., by their ability to travel, but the spatial perspective of our globe, is also affected by political context.
When in the 1930s German geoscientists endeavored to develop an "Aryan" geology, they voluntarily replaced the global geological perspective with an ultra-nationalist, strictly local stance, which was informed by national-socialist "blood and soil" mysticism. Even though, this remained a minority initiative, "German Geology" surreptitiously permeated the broader theoretical base of geology in contemporary Germany.
This talk explores spatial scales in the mind-set of geologists, who functioned in this ultra-nationalist and racist environment, which restricted not only their base of operation but also their frame of reference to their own homeland and to occupied territories. Thereby scientific isolation was not just caused by World War II, but also by a widespread racist and chauvinistic attitude towards foreign colleagues, which prevented the reception of foreign scientific achievements – which otherwise might have expanded local interests to the global scale.
Thus, we raise the question, of how much of geology in this context was a function of ideology.

Contribution ID: 893
Caught between cosmos and crystals, space and time: John Herschel's planet Earth

Gregory Good
Center for History of Physics, American Institute of Physics, College Park, United States

Observing nebulae through his 20-foot telescope, John Herschel studied the farthest reaches of the cosmos. Experimenting on the passage of polarized light through calcite and other crystals, he studied the inmost workings of the forces and structure of matter. His ideas ranged over the scale of distance from the very large to the very small. What is not as obvious is that this range of spatial scales implied an equal range of time scales. His deep understanding of the application of gravitational theory to the solar system "involve the history of the past and future state of the planetary orbits during ages, of which…we neither perceive the beginning nor the end." (Treatise on Astronomy, 1833, p. 315). His studies of crystalline optics resolved crystalline structure below microscopic detail. His studies of Earth travelled encompassed the very large and very small in space and time.

Symposium (Part 2/2) Women and academic careers in Central and Eastern Europe after the 2nd World War (1945–1968). S held in honor of Soňa Štrbáňová (Com on Wom and Gender in Scie, Tech and Med) - ID 18

Contribution ID: 481
Microbiologist Jindra Málková (1914-1954) between family, science and ideology.

Martin Franc
Department of History of Academy of Sciences, Masaryk Institute and Archive of Czech Academy of Sciences, Praha 8, Czech Republic

The life story of the microbiologist Jindra Málková, née Závadová (1914–1954), is an interesting and inspiring testimony of the extremely complicated situation of female scientists in Czechoslovakia in the decades around 1950, torn apart between family care and science. Jindra Závadová came from a socially disadvantaged environment which may be one of the reasons why this extremely talented girl engaged in the Communist movement as early as during her secondary school studies. The bacteriologist and microbiologist Ivan Málek (1909–1994), became the man of her destine; it was him who convinced her to study medicine. They got married in 1934 and together had a total of 6 children. As an avid Communist, she persuaded her husband to follow this orientation, too. In the late 1940s she also started cooperating with him closely, helping him build the Central Institute of Biology (the Institute of Biology of the CSAS from 1953). Just like her husband, Jindra Málková strongly engaged herself in the support of Lysenkoism and adapted her scientific research to suit its goals. She had more and more difficulty coping with her huge stress at work and at home but her husband strictly refused her effort to abandon scientific work. Feelings of disappointment due to scientific failures and the development of the society, her health problems, and a strong but complicated relationship with her husband, at that time already

one of the most influential figures of Czechoslovak science, eventually resulted in her voluntary decision to end her life's journey.

Contribution ID: 30

Could a woman become a professor of mathematics in a communist – ruled Poland?

Danuta Ciesielska
Polish Academy of Sciences, L. & A. Birkenmajer Institute for the History of Science, Warsaw, Poland

I will present three stories about Polish women who became professors of mathematics with chair after WWII.
The story of Polish women studying mathematics started quite early. A Polish born and educated Nobel laureate Maria Skłodowska-Curie graduated in mathematics from the Sorbonne in 1894. In the interwar period five women obtained PhD mathematics in Second Republic – Stanisława Nikodym, Janina Hosiasson, Sara Weinlös , Lidia Seipelt and Halina Milicer-Grużewska, none became a professor. During WWII German Nazis killed Hosiasson and Weinlös. After WWII Grużewska and Seipelt stayed in Poland and worked as associated professors. The first story will be about Nikodym; her husband Otton and she left Poland after WWII. For a coveted academic career she left Poland and became a professor of mathematics in the USA. Female professors of mathematics in Poland until 1970 worked in logic – Helana Rasiowa and Wanda Szmielew, in differential equations – Zofia Mikołajska-Mlak, Zofia Szmydt and in mathematical education – Zofia Krygowska. The second story will be about Szmydt. Her career was brilliant. She was the first woman granted the Banach Prize (1956) of the Polish Mathematical Society and the second female professor of mathematics in Poland. The last story will be dedicated to Krygowska. She was a Polish delegate in international groups concerning new methods of teaching of mathematics and was responsible for the national curricula for the secondary schools. And she, without regular education in mathematics, was a professor of mathematics and the most influential person in Polish mathematical education for more than 25 years.

Contribution ID: 1322

Reminiscences and recollections of an "amateur" historian of science

Soňa Štrbáňová
Department of the History of Ideas and Conceptual History, Centre for the History of Sciences and Humanities, Institute of Contemporary History, Czech Academy of Sciences, Prague - Dejvice, Czech Republic

The speaker will deliberate over the problem how to succeed in history of science without really trying (and being a woman). Her argumentation will be based on case studies taken from real life.

Symposium (6/7) 16th Annual Symposium of the Social History of Military Technology (ICOHTEC) - ID 129

Contribution ID: 336

Does the military need history?

Matitiahu Mayzel
History, Tel-Aviv University, Tel-Aviv, Israel

Does the military need History? Does the military think it needs History? I intend to discuss this question for the army of Israel, the IDF, during its formative years, from 1948 to the early 1950's. During this period the population of the country more than doubled, its economic base expanded immensely, the educational system grew very much. Yet after its success in the war which ended in 1949, the military at first contracted, then gradually increased in size and power. The violent relations with the neighboring countries became more explicit and intense. In my discussion comes the question on the rise of the need to write the IDF history, the contents of the history written on, by, and for the military. The question of ideology, i.e. how does the early military history of Israel reflects the dominant ideology of Zionism. The question on the concept of 'official' history: what is the 'official history' of an army, of a country. How does such national official history stand against other forms and versions of history. Another question is on the organization crated for writing such history: is there any unit created for writing the history of an army and the wars of the country. Is such unit an integral part of the military? How was such unit created, What was its product? While there is a considerably large body of historical literature on the military history of Israel, yet there is no Israeli official military history.

Contribution ID: 877

On civil service: reusing military assets for civilian purposes in Italy 1945-1955

Ciro Paoletti, Loredana Vannacci
Italian Commission of Military History, Rome, Italy

When in 1945 world War II ended in Italy, the US 5th Army had tens of thousand of vehicles, and mountains of equipment and ordnance.
As soon as US demobilization began and the 5th Army had to leave, it was clear that it was not convenient to bring back to USA all the vehicles and most of the heavy materials used in Italy during and soon after the War
Vehicles were not new, and they were far more than needed by the US Army according to its post-war size, nor it was necessary to move them to other parts of Europe, for the same problem existed wherever American troops were.
So, also due to the push provided by the Marshall Plan, the US Armed Forces left in Italy a huge quantity of used vehicles, pontoons, and other materials.
A purposely organized Italian authority was tasked to sell and distribute them.
The story of this authority is not that important, and was not long. It's important the impact these assets, especially vehicles, had on Italian daily life soon after the war.
They were exploited as they were, or, often, they were modified to fulfill some specific needs. Not that many of those vehicles survive today, but a good quantity of them is preserved in a country museum, south of Rome, and the paper deals with them, their use and their relevance during the Italian reconstruction in 1945-1955, as a still living evidence of military technology influence on social history.

Contribution ID: 900
Warfare in the Cyber Age - Blurred Boundaries, New Trajectories for Conflict and Competition, and the Growing Cyber Role of the Private Sector in National Defense

Christopher Weimar
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The paper proposes that cyber technology is changing the trajectory of how actors in the international system compete and conduct warfare, allowing for persistent engagement in a contested environment between actors. Cyber technology is an essential element of the military, leading to new weaponry and means of war, albeit non-violent most times, and new paths for state conflict and competition. Cyber activities put all elements of a country at risk. It can be used through indiscriminate and ambiguous means to destabilize the economic, financial, and social fabric of a country. Cyber technology in warfighting gives a continued rise to the private sector as an integral state partner for national defense. My major conclusions are - 1. The cyber environment of the 21st century has led to a changing security environment and new aspects of warfare that blur the distinctions of combatant and noncombatant and is guiding us to a broader understanding of national security. 2. Cyber allows for greater participation in national security from non-government, private sector actors. Cyber technology and its effects in warfighting fuel the behavior of major powers, like the United States, to include private sector expertise, as a force multiplier, supporting national security, military operations, and force projection, globally. 3. Cyber technology has helped create an essential and permanent relationship between private contractors and the U.S. armed forces for the provision of U.S. national security.

Symposium (Part 1/2) Scientific Instruments and Literature (Commission on Science and Literature) - ID 286

Contribution ID: 682
Tell-tale instruments in Herman Melville's Moby-Dick

Sara J. Schechner
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Herman Melville was no stranger to life onboard a whaling ship when he wrote *Moby-Dick*. At 20, he went to sea as a cabin boy aboard a merchant vessel and soon after returning, signed up to be a deckhand on the whaling ship, *Acushnet*. He spent four years on different ships in the South Pacific before returning to Boston in 1844 at age 25. Moby Dick was published in 1851.
The novel is rich in factual details about seafaring, and whaling practices compounded with allusions, metaphors, and symbolism drawn from them. Scientific instruments—especially navigational ones—appear throughout the book. For instance, when scouting for finback whales, the sailors spy a "gnomon-like fin [that] stands up and cast shadows upon the wrinkled surface." Ishmael adds portentously, "On that Ahaz-dial the shadow often goes back." While Captain Ahab is sane, he navigates by azimuth compass, log and line, Hadley's quadrant, and chart. But as he descends into mania, he curses and smashes his quadrant, swearing he will sail solely by dead reckoning. That night,

an electrical storm throws off the compasses and soon after the log line snaps. The loss of instruments parallels the loss of logic, putting the *Pequod* really at sea and subject to the whims of a madman. This talk will show how Melville deploys scientific apparatus realistically, metaphorically, and symbolically to steer the course of the novel as well as the fateful voyage.

Contribution ID: 802
Magic instruments in literature

Convin Splettsen
Goethe-University, Frankfurt am Main, Germany

„Cups and Balls" is a classic trick and very well known from the streets, television or magic shows. The instrument used to produce an effect is a very simple, the cup. This trick has been performed over centuries and is descriped in many books. There we find other descriptions and depictions of instruments and how they can be constructed. In the 16th century they are rather simple described and develope in the 18th century into big foldable instrument plans that can be used for magic performances and scientific demonstrations and this talk will discusses this topic. How developed the magic instruments over the centuries? Was there an evolution in magic instruments and can scholars of scientific instruments learn new perspectives by looking on magic and instruments? For first answering these questions I will analyse books from the 16th century onwards, their construction plans and , tricks and include the perspective of a modern magician so it might be possible to track some developments.

The gender gap in science, and in the history of science and technology: historical perspective and IUHPST/DHST policies (Com. on Women and Gender in Science, Technology and Medicine) - ID 98

Contribution ID: 182
Gender differences in the Global Survey of Scientists

Rachel Ivie, Susan White
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The Global Survey of Scientists examined gender differences in scientists' development of interest in science, experiences in education and careers, work-life balance, family support for scientific careers, access to resources needed to conduct science, and opportunities to contribute to the scientific enterprise. The survey was deployed in seven languages starting 1 May 2018 and ending 31 December 2018. There were more than 32,000 respondents from more than 150 countries. The targeted respondents represented seven natural science disciplines and the history and philosophy of science and technology. The results of the survey confirm that the gender gap in science is very real, across all regions, all disciplines, and development levels. Women's experiences in both educational and employment settings are consistently less positive than men's. Women are less likely than men to say that everyone is treated fairly in the educational system and in employment. Women report less positive relationships with their doctoral advisors, lower doctoral program quality, and more interruptions in

doctoral studies than men. Women are less likely to report respectful treatment by co-workers than men. Women are more likely than men to report slow career progression, discrimination, and sexual harassment. Women have less access than men to career-advancing opportunities and resources. Finally, the effect of children on women's careers is notable and not positive. These findings highlight the urgency of the situation for women in natural sciences and may provide an opportunity for social scientists to make recommendations toward inclusive practices and policies in science.

Contribution ID: 233

Effects of gender on academic publishing in mathematics and physics

Helena Mihaljević
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Despite increasing rates of women conducting research in mathematics and physical sciences, a systemic gender imbalance persists at various levels in the named disciplines. In the interdisciplinary project "A Global Approach to the Gender Gap in Mathematical, Computing, and Natural Sciences: How to Measure It, How to Reduce It?" we have analyzed the gender gap in the named disciplines through the lens of publication practices. In this talk we will showcase some results regarding the presence of women as in renowned journals or as invited speakers at relevant conferences, looking at differences between the (sub-) disciplines and the development over time. Furthermore, we will reflect on methodological approaches to analyzing gender effects on publication practices, showcasing the main pain points and pitfalls typically observed when conducting such analyses.

Contribution ID: 172

History, One of Many Tools Towards New Practices for Gender Equality in the History of Science

Isabelle Lémonon Waxin[12]
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History of science is a promising tool to help narrow the gender gap in STEM. Far from just adding to the list of women pioneers in scientific disciplines, it has brought out hundreds of women scientists, forgotten by the history of the institutions or of the "great men" written prior to the 1970s. From Nobel laureates to female technicians in laboratories, their trajectories not only provide role models for future generations of scientists, but also challenge the categories of the received historical narrative, highlighting its gendered character. The history of science, even over the *longue durée*, reveals a form of continuity in the negative social representations and discourses associated with women in science. These contributions can provide tools to fight gender inequalities in scientific careers. However, history and philosophy of science itself, as shown by the Gender Gap in Science project, is far from being free of these inequalities, which are very sensitive to national contexts. What can we do as historians and philosophers of science to overcome these inequalities in our own discipline? Gender Gap studies, social and neuro sciences (Rossiter, 1982, 1998, 2012; Steele and Aronson, 1995; Charles and Thébaud, 2018; Rippon, 2019…) give us many hints on how to implement new policies to promote gender equality.

Contribution ID: 181
Victorian women in the natural sciences: Historical perspectives for current Gender Gap work

Don Opitz
School of Continuing and Professional Studies, DePaul University, Chicago, United States

In this paper, I will analyze patterns of Victorian women's participation in the natural sciences, particularly the obstacles encountered and strategies employed to overcome them. My analysis will consider several case studies drawn from nineteenth-century Britain to illustrate the broader patterns, and particularly the importance of networks that supported women's scientific education and pursuit of research. The historical lessons based on the Victorian context illuminate the importance of accounting for the particular social and cultural dynamics which influence prescriptions for women's roles and the ability to challenge established norms. But history also underlines the importance of accounting for the distinctive factors of present society that compel new strategies for achieving gender equity in the sciences. This paper, then, suggests both the applicability and yet limits of history to inform current work in closing the "Gender Gap."

Symposium (Part 2/4) Mathematical proofs and styles of reasoning: East vs. West - ID 55

Contribution ID: 89
Did Lobachevsky have a model of his "imaginary geometry"?

Andrei Rodin
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The invention of non-Euclidean geometries is often seen through the optics of Hilbertian formal axiomatic method developed later in the 19th century However such an anachronistic view on Lobachevsky's mathematical works fails to provide a sound understanding of his motivations and research strategies. Unlike what the name of ``imaginary geometry'' may suggest, Lobachevsky's major motivation behind his geometrical achievements was to develop geometry on empirically relevant (rather than abstract and idealised) mathematical concepts and thus make it better applicable in natural sciences.
The modern notion of model of a given theory has a counterpart in Lobachevsky's writings but its role in Lobachevsky's geometrical theory turns to be very unusual. Lobachevsky doesn't consider various models of Hyperbolic geometry, as today normally does any student of this theory, but builds instead a non-standard model of Euclidean plane as a particular surface in the hyperbolic 3-space, and on this basis develops an analytic calculus known today under the name of hyperbolic trigonometry.
In my presentation I shall survey this Lobachevsky's construction, and argue that Lobachevsky's empirically-oriented thinking about geometry and mathematics in general remains relevant and valuable in the context of today's science and mathematics.

Contribution ID: 96

Proof-events and agency: a new approach to the history of proving

Ioannis Vandoulakis
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Mathematical proofs are understood in traditional philosophy of mathematics as establishing mathematical *facts*, corresponding to *truths*. Instead, we advance another approach, based on the concept of *proof-event*.
Proof-events include not only completed proofs, but also incomplete, flawed, or false proofs or even proofless expositions of ideas on a posed *problem* (defined by certain *conditions*). They occur at specific places and times and therefore are temporally extended unrepeatable occurrences, in contrast to mathematical facts or states of affairs that are considered as universals.
Proof-events presuppose at least two agents enacting distinct roles: a *prover* (human or machine or combination of them), and an *interpreter* (human or machine or group of machines or combination of them). The roles enacted by agents determine their *tasks* with respect to the posed *problem*. All agents are equipped with past background knowledge, past learning experience and mastery of certain practices. They may have different visions of the problem, use different communication media, belong to different mathematical (or logical) worlds, think in different (local) *logics*; they may be giants, dwarfs, or amateurs! However, they must share a common *interpersonal space*, for communication to be possible.
A sequence of proof-events with reference to a fixed posed *problem* evolves in time represents the *history of proof*.
Thus, proving can be viewed as *distributive cooperative discovery activity* of a *multi-agent system* evolving in space and time.

Contribution ID: 136

Diagrammatic proofs in the east and west

Jens Lemanski
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Until the end of the 20th century, diagrammatic proofs were viewed sceptically or even rejected by mathematicians and logicians. However, in the history of mathematics and logic, there are numerous examples of successful diagrammatic proofs: Prominent is the example of Pythagoras' theorem, which goes back to the Indian mathematician Bhâskara and was rediscovered in Central Europe in different centuries. Another example of successful diagrammatic proofs are logic diagrams, which have been developed since the 16th century and became known through Leonhard Euler. However, this diagrammatic method of proof was only generally accepted as a formal logical system in the 1990s through the work of Sun-Joo Shin.
In this lecture, I will discuss diagrammatic proofs in mathematics and logic, showing how the interaction of Eastern and Western thinking has led to the current evaluation of diagrammatic proofs. I will demonstrate this interplay using the theorem of Pythagoras in Bhâskara and Arthur Schopenhauer and the example of logic diagrams in Leonhard Euler and Sun-Joo Shin.

Contribution ID: 1294

António Monteiro and his influence on Brazilian and Argentinian Mathematics (1945-1980)

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António Monteiro, who did his Ph. D. in France with Maurice Frechet, belonged to a generation of distinguished Portuguese mathematicians and physicists that, from 1936 to 1945, were able to create the first authentic research groups in Portugal, as well as to found the *Portuguese Society of Mathematics* and its two journals, an international research journal, the *Portugaliae Mathematica*, and one dissemination journal, the *Gazeta de Matemática* (Mathematics Gazette).
Because of the impossibility of getting a public job under the then existing dictatorship, Monteiro left for Brazil, where he arrived in late 1945. We will give an overview of his years in Brazil (1945-1949), where he taught at the *National Faculty of Philosophy of the University of Brazil*, then the second best centre for mathematics in Brazil, was an editor of the journal *Summa Brasiliensis Mathematica,* and started the publication of the series of research books, Notas de Matematica (Mathematical Notes), which in the 70s were published by North Holland.
Because of political action from the Portuguese dictatorship he was forced to leave the country and establish himself in Argentina, where he changed the course of Argentinian Mathematics. We will give an overview of his action in Argentina. He first was at the *National University of Cuyo,* in San Juan, where he co-founded the journal *Revista Matematica Cuyana*, (Cuyan Mathematical Journal) and later was at the *University del Sur*, where he organized the then recent *Institute of Mathematics*, and started the publication of several research journals.

Symposium (Part 1/3) Meteorological and magnetic observatories in the 19th century - ID 276

Contribution ID: 569

North and south: knowledge exchange between the magnetic and meteorological observatories of Greenwich and the Cape, 1841 to 1910

Louise Devoy
Royal Museums Greenwich, Greenwich, United Kingdom

Founded in 1841, the Magnetic Observatory at the Royal Observatory of the Cape of Good Hope, South Africa, was one of four colonial magnetic observatories established by members of the Royal Society and the British Association for the Advancement of Science. The magnetic observations were initially overseen by Lieutenant Frederick M. Eardley-Wilmot (1812-1877) of the Royal Artillery before they were handed over in 1846 to Her Majesty's Astronomer at the Cape, Thomas Maclear (1794¬–1879). The observations continued in parallel with the Cape Observatory's astronomical work until Maclear's retirement in 1870, after which they were abandoned, apart from a few observations taken during local

survey expeditions, such as the work of J.C. Beattie (1866–1946) who published his *Report of a Magnetic Study of South Africa* in 1909.
In this paper, I will review the long-standing relationship between the magnetic observatories at both the Cape and the Royal Observatory, Greenwich, during the tenures of the Astronomers Royal George Biddell Airy (AR 1835-1881) and William H. M. Christie (AR 1881-1910). By reviewing the surviving records, correspondence and publications, I intend to explore the extent of knowledge exchange between the two organisations with respect to their magnetic and meteorological observations, from decisions made about the type and frequency of observations, the choice of instruments, the recruitment and training of staff and the dissemination of results. I will also explore how personal interests and agendas behind these 'mag and met' observations influenced the advice and recommendations provided by Airy and Christie respectively.

Contribution ID: 678
Kew observatory in europe and beyond, 1850-1900

Lee Macdonald
Royal Museums Greenwich, London, United Kingdom

Alongside the *Magnetische Verein* and Magnetic Crusade, Kew Observatory was an important development in the organisation of the geomagnetic and meteorological sciences in the nineteenth century. Originally a private observatory for King George III, it was relaunched in 1842 as an experimental observatory by the British Association for the Advancement of Science (BAAS). Thereafter, Kew Observatory quickly established a reputation as a pioneering centre for meteorological observation, including the development of self-recording meteorological instruments. After 1850, it became world-renowned as a centre for magnetic observations, solar photography and also testing scientific instruments.
Kew Observatory is known to historians principally as a nerve centre for these sciences in the British Empire. However, less well-known is the influence of Kew on magnetic and meteorological observatories more widely, especially in continental Europe. From the 1860s, directors of European observatories such as Coimbra and Lisbon frequently corresponded with Kew about setting up and running magnetic and meteorological instruments. Kew sometimes built instruments to order for continental observatories, such as an instrument for measuring atmospheric electricity supplied to the Royal Madrid Meteorological Observatory.
In this paper, I show how Kew Observatory influenced the work of European geophysical observatories, including how three of them - at Coimbra, Lisbon and Paris - were at least partially modelled on Kew. I argue that, by disseminating technical knowledge through a network of contacts with observatories in Europe and beyond, Kew Observatory played an essential part in the internationalization of the Earth sciences in the second half of the nineteenth century.

Contribution ID: 752
Astronomical labourers and the self-registering instruments of the Magnetic and Meteorological Department of the Royal Observatory at Greenwich 1838-1881

Daniel Belteki
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The 'Magnetic Congress' held in June 1845 in Cambridge resolved that the Magnetic and Meteorological Department of the Royal Observatory at Greenwich be permanently continued. This compelled George Airy (director of the Observatory) to reconsider the future of the Department's instrumentation. Given the strenuous labour involved in manually reading the magnetic and meteorological instruments, he began contemplating the introduction of photographic self-registering apparatus to ensure the constant measurement and recording of magnetic and meteorological observation. Through the Admiralty, Airy announced an award for inventing a self-registering apparatus that could be implemented at the Observatory. This fuelled the existing competition between Francis Ronalds and Charles Brooke to develop such instruments.
The new self-registering instruments were placed under the use of the Magnetic and Meteorological Assistants. Yet their interaction with the apparatus has remained relatively little known. Examining how the assistants managed and interacted with the instruments tells us more about the maintenance and management of magnetic and meteorological instruments at national observatories. In addition, it demonstrates the assistants' expertise and skill in handling scientific instruments. It also shows the extent to which Airy was reliant on the knowledge of the assistants in the daily running of the Department, and in disseminating technical knowledge about the instruments to other observatories. Thereby, this paper demonstrates how the local actions of the 'invisible technicians' of the Observatory contributed to the further developments of instruments used beyond the British Empire.

Symposium (Part 3/5) Computing in the sciences and in technology. An Aristotelian perspective (HaPoC) - ID 13

Contribution ID: 42

Computers in the service of Ekistics: On the science of human settlement in the post-war period

Nathalie Bredella
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Looking at the history of networked planning strategies, this study traces the work of Ekistics—the science of human settlement—a term derived from Constantin Doxiadis, who together with Jaqueline Tyrwhitt fostered the notion of global environmental management through the famous Delos symposiums and publications such as the Ekistics Journal. Contributors including Buckminster Fuller, Marshall McLuhan, Margaret Mead, Conrad Hal Waddington, Barbara Ward and others propagated a holistic view of the city, region, and society, and addressed environmental and ecological issues. Instead of rigid planning scenarios, they proposed flexible and adaptable programs based on systems theory, working from the assumption that the problems of the present could be solved through interdisciplinary knowledge exchange and the technical and scientific means of modernity. I am especially interested in how Ekistics members conducted their studies into the material conditions of a place in connection with global planning strategies. Looking at the journal issue "Computers in the service of Ekistics", my contribution will discuss the role data collection and visualization processes played in the early days of 'smart' planning.

Contribution ID: 137

How computers helped to build Czechoslovak dams in the 1950

Helena Durnova
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When the Czechoslovak Academy of Sciences was founded in November 1952 as a key institution of socialist science, research in computing was but a small branch of the Mathematics Institute of the so-called First Branch of the Academy, i.e. the branch for mathematics and physics. The emerging form of research organisation paid strong attention to the application of the research conducted as well as on the co-operation between the individual researchers, as research driven by internal motivation was considered bourgeois. Hence mathematicians as well as the researchers working on the expensive projects of the mathematical machines had to prove themselves useful.
In the socialist dream of taming the nature, a series of dams was suggested to control the rivers. The civil engineers used a special kind of concrete to build the massive objects, but there was little guidance to be gained from experience as to how to manage the flow of concrete, how the massive walls might react to the changing temperature during the years, and other aspects. Calculations were a way to understand the process prior to the construction. Mathematicians specialising in differential equations joined forces with the ones who understood mathematical machines. Their close co-operation gave rise to the different ideas of organising such research as well as to a new kind of an applied mathematician. The first Czechoslovak automatic computer also played a role in this story.

Contribution ID: 180

Theoretical and practical objectives of early machine translation in the 1960s

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In my paper, I would like to examine how early Machine translation was a place of tension between practical objectives, political constraints, technological advances and theoretical issues.
Early Machine translation (1949-1964) was a war technology, worked out by the winners of the World War II, that is the USA, the former USSR, the UK and France. It was involved in the Cold War where it played a strategic and economic role and had the practical objective of translating scientific texts in series from Russian into English. It was the first non-digital application of electronic computers so that the difficult task of processing texts had to be performed with reduced memory capacity and speed. In the USA, MT was funded by the state, mainly by the CIA, so that it underwent regular evaluations which concerned the quality of translations, their costs, and the comparison with human translations. The final evaluation carried out by the ALPAC Committee in 1966 put an end to the experiments on the United States. Finally, MT arose difficult theoretical problems of which the MT pioneers were aware: what is it to translate a text from one language into another? What is a good translation? Is Full Automatic High Quality Translation feasible? What conception of language does this imply? What role for linguistics in MT? In my paper, I will examine how MT pioneers, in particular Warren Weaver and Yehoshua Bar-Hillel, faced these various challenges and issues which eventually led to technological advances and significant changes in linguistics.

Contribution ID: 332
The telos of confrontation: The place of ideology in history and historiography of Cold War computing

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A nutshell history of modern computer comes with the tag of an "American machine." A progress line stretching from the ENIAC to the internet offers a coherent narrative arc which culminates with the *FAAMG* and its $4 trillion capitalization. This story of triumphs, however, generates its own counter narratives, such as Kai-Fu Lee's *AI Superpowers: China, Silicon Valley, and the New World Order* (2018), and relies on the plot of a "new" Cold War. In this light, I take the notion of confrontation as a lens to consider the relevance and the limits of the history of computing and to argue for an inclusive historiography. My reflection concerns the ideological dimension of computing during the second half of the twentieth century as well as the literature structured, explicitly or implicitly, by the narrative of Cold War confrontation. I will first survey several foundational texts in the field: *Computer: A History of the Information Machine* (1996), *The Closed World: Computers & the Politics of Discourse in Cold War America* (1996), and *The Government Machine: A Revolutionary History of the Computer* (2003). I will next discuss a series of challenges, destabilizing and complicating these master narratives, raised in recent historiography and in my own work on Soviet programming and cybernetics. In particular, I will focus on the following dichotomies: confrontation as analytical vs. actor category; mechanisms of circulation versus effective and metaphorical barriers symbolized by the Iron Curtain; and the duality of hardware and software histories.

Symposium (Part 2/2) Politics, Protest and Big Technology (ICOHTEC) - ID 565

Contribution ID: 640
Lewis Mumford on science, technology and power

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In his „Pentagon of Power", the II volume of the „Myth of the Machine", Lewis Mumford pays special attention to the relationship of science, technology and power. Mumford blames Galileo for eliminating the subjective moment from our dialogue with nature that opened the way to the machine like attitude to the world. According to Mumford, this move also laid the foundation to new type of power relations in society that dethroned the polytechnic tradition of the middle ages. This is true that Galileo successfully created an objective method that was aimed at being value free. The scientific method exists and science has been making progress. Therefore, science is really at least partly responsible for the success of modern technology as well. However, I am going to argue that the move of Galileo was necessary in order to develop not only science and technology but also the power relations in society. The polytechnic approach of the middle ages was exhausted by the beginning of modernity. A fresh start was needed.

Calling the machine for help was a logical development. There is a positive look at the machine from the power relations point of view. We needed the machine like build-up of society in order to open the way for modern democracy to unfold and develop.

Symposium (Part 1/3) History of technology and museum business in XXI century. New actors, new networks, new and old issues - ID 558

Contribution ID: 868
E-POSTER Museum or "shelter for old machines"? The case of private local museums

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Technical museums in Russia in recent years are increasingly represented by local private initiative. Arise spontaneously, often outside of any legal field and suddenly disappear, since their existence completely depends on the owner. One of the first arose in the 1990s in the village of "Gory"(near Novrogod) as the "museum of household design". For such museums, the "all in a row" approach is most characteristic, without any filtering or organizing their exhibits. They bloom in a few months, and then slowly die, unable to cope with the illusory simple and cheaply obtained exhibits, lack of funding and imaginary support from society. Nevertheless, at the moment there are some examples of quite successfully developing museums of this type like the "Shelter of old machines in Burtsevo". However, there remain problems of organizing exhibits, which turns out to be an extremely difficult issue for non-professional collectors, restoration and conservation (which museums cannot cope with due to the number of exhibits), legal status (at least large exhibition spaces are required, which are very difficult for owners to take ownership of). But they try to distance from the state as much as possible, thereby jeopardizing the fate of their collection. Many museums refuse the help of professional museum workers, believing that any formalization will destroy the identity of the museum. In this report, I would like to show several scenarios for these museums and analyze the balance that they are trying to maintain while remaining a museum or simply become a "shelter".

Contribution ID: 896
E-POSTER Making the way to post-industrial museum

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Regardless of our attitude to the very concept of a post-industrial society, it is quite obvious that technological improvements made over the past 50–70 years and transforming modern life in such a substantial way should be adequately reflected in public memory institutions — archives, libraries, museums. Especially strong is the relevance of issues related to this process for museums of science and technology, because directly affects the most diverse aspects of their everyday's activities: from the

compilation of new scientific concepts to complete collections, to the preservation, access, functionality, conservation and restoration of complex technical objects and systems.
Complex issues on methodological, legal and practical levels growing with appearance of new institutions (virtual, private, corporative, etc museums). Harmonization wanted. The success of solving these issues directly depends on the degree of their elaboration. It is important today to outline possible ways to ensure the preservation and representation of post-industrial heritage.

Contribution ID: 924
E-POSTER Connected computer brands - how big brands connected unknowingly with each other

Bart van den Akker
HomeComputerMuseum, NK Helmond, Netherlands

This paper will demonstrate how computerbrands were connected through the history without them knowing. Amiga never would've existed without Atari, Matra never would release the Alice computer in France and our mobile phones should be Sinclair.
The paper describes the history in a way you'd never expect. Did you know the Atari 2600 and Amiga are related? Or how the American Exidy Computers and Dutch Tulip Computers became one and eventually even Commodore? An interesting way to oversee how brands are connected and how they impact the current IT in a way they never would've thought back then.

Contribution ID: 933
E-POSTER Computer museum as ICT technology archive

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Institute of Mathematics and Computer Science maintains Computer Museum established in 1984. Museum holds 13 116 exhibits, including: 44 printers, 287 mainframe and workstation parts, 98 parts of БЭСМ-2, БЭСМ-4, ЕС ЭВМ, IZOT, personal computers, various documents and photos.
International Council on Museums (ICOM) in 2019 accepted a new definition of Museums. Public museums traditionally should be financed from the State and local government budget, receive a donation or a gift with or without a specified objective. If we consider the institute's museum maintenance capabilities, we could divide the required activities into two levels: 1) acquisition, documentation, conservation and maintenance of museum exhibits in the museum building; 2) all other museum activities to the public society described above.
Because of the difficulty attract public funding and donations for our museum, we see the following model for its operation: the activities mentioned under point 2) are provided in a virtual (Internet) environment, but the conservation of museum collections as usually ensured. Mainly museum operates as an archive of technology. Museums and archives have much in common: archives accumulate documents of the past, while museums collect things. There is one exception in Latvia — archives are competent to collect films, video and audio texts.
The definition of a technology archive is often used by corporate museums. Archive is a place for storing earlier documents for historical interest, National archives are usually publicly funded.

The article compares the operation of archives, museums and technology archives more detailed, and analyzes their trends.

Symposium Popular Representation/Misrepresentation of Modern Physical Theories (Commission on the History of Physics) - ID 225

Contribution ID: 1291

Whittaker, Einstein and the History of the Ether. Alternative interpretation, blunder or bigotry?

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Edmund T. Whittaker's second edition of his *A History of the Theories of Aether and Electricity* is famous for his treatment of Einstein as an almost irrelevant character in the emergence of what he called "the relativity theory of Poincaré and Lorentz." Historians of science have given a number of explanations which include Whittaker's scientific conservatism as an old classical physicist, his commitment to the ether, the pre-eminent role he attributed to mathematics over physics, or foundational philosophical disagreements, to name a few. And in the background, often more implicit than forthright, the accusation of anti-Semitism looms over Whittaker. In this paper I intend to bring new light on this controversy by taking into consideration the abundant correspondence between Whittaker and his son. With it, we shall get a more complex and personal view of the context in which his attempt at dethroning Einstein took place. Together with the above-mentioned reasons, this correspondence shows that the problematic status quo of general relativity in the early 1950s, a period that has been described as the low-mark of GR, was very influential in the historical treatment he gave to Einstein. This is an aspect hardly mentioned in the historical work on this controversy and which, from this correspondence, appears to be rather central to understand Whittaker's at the time of drafting the new *A History*. His his possible anti-Semitic bias will also be addressed, though with the insufficient information on this subject the matter cannot be settled.

Contribution ID: 274

Causation and morality: Herbert Samuel and Arthur Eddington about Heisenberg's principle

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Arthur S. Eddington (1882-1944) certainly was the world's most famous astronomer during the interwar period. For thirty years he was the director of Cambridge Observatory and a Fellow of Trinity College. He also wrote widely acclaimed popular books such as *The Nature of the Physical World* (1928) or *The Expanding Universe* (1933). From 1927 onwards, he undertook to present quantum theory in general, and Heisenberg's principle in particular, to a lay audience. These *exposés* triggered a strong reaction by diplomat & politician Sir Herbert Samuel, at that time the leader of the Liberal Party. Thanks to various

papers and lectures Samuel launched an attack on Eddington's views. He vigorously insisted on the political disaster implied by what he understood as the elimination of the principal of causality: "Any foolish superstition, any irrational act in private conduct, any perverse policy in public affairs, would be able to justify itself, if once the principle is admitted that events need not be the outcome of precedent causes". This paper intends to elaborate on Samuel's reactions and Eddington's response to it, grounding on published documents and on their private correspondence. Eventually, it represented an occasion for Eddington to clarify some major concepts such as indeterminism, indeterminacy and prediction.

Contribution ID: 1185

Goethe ab omni naevo vindicatus (fere): 20th-century physicists reread Goethe vs. Newton

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During the 20th-century, the exquisite scientific dilettantism (first and foremost, in its etymological sense: taking 'diletto' – pleasure – in doing something) of Johann Wolfgang von Goethe received praise, or the respect given to a dialogical pole, in some trends of life sciences and, particularly, morphology. In physics, his polemics against Newtonian optics, alas, is not rarely mentioned as a singular instance of incompetent stubbornness, or quickly disposed of as an embarrassing incident: not exactly a worthy facet of Goethe's 'giant' stature. Nonetheless, Goethe's presence in the mind of 20th-century physicists is not a negligible chapter, as systematic omissions of some kind of historians, perhaps puzzled by him as if they were in front of some old-style knick-knack in a scientist's office, seem to suggest. From E.Schrödinger to F.London, from A.Einstein to W.Heisenberg, and even in later generations in far-away Japan – e.g., Y.Nambu –, Goethe's presence can be assessed, not only due to the pre-eminence of his literary work but to a suffused *Naturphilosophie* as well, not easily expressible in barren analytical terms – and why would one need to rephrase it otherwise, when Goethe himself expressed it magnificently in his own words? Even more significantly, physicists of the calibre of Heisenberg and Pauli, and their disciples Weizsäcker and Fierz, while recognizing the 'mistakes' of the Goethean polemics in optics, tried to extract from that episode important lessons and expectations about the future of science, as well as assessing Goethe's greatness even in that 'blunder' – and that is what this paper will address.

Contribution ID: 1313

When space-time met the world revolution

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The public that was trying to survive the combined calamities of the Great War, the Russian revolution, and the ensuing Civil War, perceived the idea and the spectre of an impending World Revolution in combination with another radically modernist revolution – scientific. Einstein's relativity theory was changing not just the historical, but the universal concept of Space-Time. Its special version had been known in Russia already prior to WWI, but became the main cultural sensation there, as in other countries, after 1919, with the arrival of the general theory of relativity. The process of its reception in

revolutionary Russia has been studied very selectively, with attention to professional physicists and to a few Marxist critics of relativistic philosophy. Such a narrow focus served the well-established idiom of an evil ideology oppressing good science, but the main body of responses came neither from professional experts nor from Marxists, but from the educated public of all kinds – artists, medical doctors, religious mystics, poets, philosophers, mathematicians, et alia - who represented an entire spectrum of ideological convictions. Together, they produced as wide and incoherent body of reactions, interpretations, and misperceptions as what characterized the popular response to relativity elsewhere. Yet some of the commentaries were more idiosyncratic, reflecting the culturally specific realities and existential experiences of a society in the whirlwind of revolutionary change. Among many other unconventional proposals of such sort, one finds the idea of a non-stationary cosmology, the seed of what would eventually become the Big Bang model of the relativistic Universe.

Symposium (Part 1/2) Knowledge Cultures of the In-Between (Europe/East Asia): Mixtures, Communications and Ruptures in Material Cultures of Knowledge - ID 340

Contribution ID: 570

Using female body drugs for healings and longevity in Late Ming China

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In pre-modern China, the terms "Red Lead" and "Purple River Chariot" referred to two kinds of drug made of female body parts. "Red Lead" was made of women's menses, and the "Purple River Chariot" was processed from human placenta. Both of them with religious connotations had become well known to those interested in the healing arts for maintaining health and prolonging life, especially in the late sixteenth and early seventeenth century. The "Red Lead" was in particular popular at the Court for certain emperors, who had been obsessed with sexual potency, longevity and immortality. Unfortunately, it in turn led to one emperor's immature death due to his overdose and misuse of the drug. By contrast, the "Purple River Chariot" was widely used among the wealthy through the society. It was believed that this drug can cure a wide range of diseases for both men and women, even to save people from dying. My interest is thus to explore the materiality of women's menses and placenta as medicine, for better understanding the gender aspect of health maintenance and body nourishment in the late Ming. In addition to the views of body, medicine and healings, my paper will also detail the specific political and social milieu, in which the obsessions and mis/conceptions of human body drugs were nurtured.

Contribution ID: 725

Women's medicine in premodern Europe (2): Conceptions of birth, hands, time and the world: from premodern to modern obstetrics

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Birthgiving and obstetric assistance have a long history of technologies (in the broad sense of the word) and they have been the object of – gendered – social, religious and scientific regulations. Previous studies on the history of European midwifery have revealed a multiplicity of practices, but also the loss of agency on the side of the midwife and the parturient which became manifest in 18th century, and the concomitant introduction of obstetrical instruments by academic medicine. These instruments also represented the introduction of a mechanical understanding of the human body, which slowly but steadily morphed into an object subjected to a homogeneous and linear time. But which were the concepts of bodies and time before this new paradigm? In this paper, I would like to examine the symbolic underpinnings of Early Modern midwifery texts. How is the agency of the midwife's hand, the maternal and the fetal body represented and how do this representations interact with patterns of time, space and creation? Can we find common structures/concepts in different premodern cultures that navigate the female body from a paradigm of creativity to one of productivity? The analysis will be based on Early Modern textbooks of midwifery both by male and female , taking into account feminist methods of history of the body as well as comparative studies on body concepts in Western and Chinese body concepts.

Contribution ID: 699

Eumenol—merck's patent emmenagogue and its chinese contexts (1896-1961)

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Custom officer Friedrich Hirth (1845-1927) returned from China with one important *materia medica, Danggui.* His knowledge of Chinese medicine and related connections attracted the attention of E. Merck. The Darmstadt pharmaceutical company signed a contract with him in 1896, and also a Munich physician Dr. Heinz, to test the herb for future production of a new drug. After Heinz confirmed that the plant would not induce abortion, Merck began to import *Danggui* roots from China and to produce "Eumenol" from its extract.

Hirth published an article in 1899 to introduce Merck's new patent emmenagogue. Since European medicine had not been able to provide an effective and harmless drug for amenorrhea, Eumenol began to appear in promotional documents as the bio-medical solution for menstrual disorders. The uncertain identification of *Danggui*, whether it was a native Chinese Araliaceae or it belonged to the Umbelliferae family, did not hinder the business. Eumenol was sold in Europe and South America, and even exported to China. Newly established Chinese industries challenged Merck's dominance by producing similar drugs, but the Chinese often referred to Hirth's article for the efficacy of a new form of menstrual medication. It was only in 1961 when global politics obstructed transportation of the roots did Merck stop producing Eumenol.

This article examines the rise and fall of Eumenol based on documents in the Merck Archive, and tries to portray the transmission of medical materials and knowledge between the two hemispheres in the first half of the 20th century.

Contribution ID: 766

Translation, Production and Application: Western Medicine at the Early Qing Court

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Western science and technology had been introduced into China since the late sixteenth and seventeenth century. Due to the needs and advocacy of the Manchu emperors, the Jesuits were invited to the Qing Court to teach medical knowledge. In addition to translation of Western medical books, they were also required to produce medicines in the Court. Hence, the Court had become the main window for exhibitions of Western medicines in the early Qing Dynasty. Among the medicines that the Jesuits had brought into China, only *gingina*, *deriyaka*, *ulebe berladu*, *balsamun* and *bas di liyo* were produced in the Court under the request of Emperor Kangxi (*r.* 1661-1722). They were later used for treating diseases. My research will thus be focused on these medicines by raising several questions: What kind of medicines are *gingina*, *deriyaka*, etc.? How was the knowledge about these medicines translated into the Qing court? There had been many Western medicines introduced into China since the seventeenth century. Why did the Manchu emperor choose them for manufacture and treating diseases? Who would be awarded these Court-made medicines? And who would manage the application of these medicines? In the perspective of social life of medicines, this research will explore how the Western medicines and their knowledge were recorded, produced and practiced at the early Qing Court. These issues involve cross-cultural exchanges and collisions of different medical systems, as well as the political power that dominated Western medicines.

Session XIV - From Late Barock Time towards Enlightenment

Contribution ID: 1153

Conflict and Controversy in the University of Halle: Social Control and the Early Sciences in Germany, c. 1694-1730

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The University of Halle is historically known as a pioneer in German educational reform, home to key actors in the developing sciences in Germany, and consequently home to the numerous controversies that surrounded them. The existence of a hotbed of controversy in what had effectively been the amphitheatre of the Thirty Years War (1618 – 1648) is perhaps cause for surprise, however what is arguably more surprising is the unity frequently found between warring scholars. Indeed, amidst the disruptive and oftentimes catastrophic changes taking place across Europe, the scientific disciplines seemingly emerge as an uncommonly controlled arena of advance, nurtured by dedicated and like-minded individuals who managed to form a cohesive community amidst the tumult. Within the town of Halle this is seen amidst a fascinating conglomeration of political, confessional, philosophical and theological variety that, despite being the source of significant discord, was more particularly intriguing in the unity that can often be found within the apparent disunity. It seems any discussion of conflict in Halle inevitably circles about a handful of key actors and events – Christian Freiherr von Wolff and his expulsion from the state perhaps the most memorable. The negotiation of conflict by scholars in and

about Halle across the half century after its founding in 1694, however, offers insights into the extent to which these scholars were masters of their circumstances, or whether they were responding to changes rather than to actively pursuing and enacting them.

Contribution ID: 1031
The idea of "science" in eighteenth-century England.

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Since the 1970's, there has been a great historiographical debate about the characterization of English "Science" in the eighteenth century, which brings together important historians. There are several possibilities for characterizing this eighteenth-century "Science": "Newtonian Science", "Experimental Science", "Enlightened Science", "Public Science", "Science as Public Spectacle", "Science as Performance", "Polite Science". Obviously, these different denominations have different meanings for the idea of "Science", but this diversity does not mean, in its turn, antagonisms and conceptual contradictions. In general, this diversity represents the existence of multiple forms of signification, as well as different contexts, for eighteenth-century "scientific practice", which are evidently associated and complement each other.
However, some historians who participated in this historiographic debate (Alan Q. Morton, Jane A. Wess, Patricia Fara, Bernadette Bensaude-Vincent, Christine Blondel and Al Coppola) sought to make clear warnings about historical and conceptual anachronisms that many participants incurred in characterizing eighteenth-century English "Science". Based on this orientation and in the consultation with contemporary , we will try to show that the meaning of eighteenth-century "Science" corresponded to the different forms and practices of "systematic", "theoretical", "logical" and "rational knowledge", establishing a complementary relationship between the two great fields that formed this knowledge: Philosophy (Natural or Moral) and Theology. Actually, what was called "Science" was the Natural Philosophy and its various specific branches and, as the tradition of experimental research had triumphed in England since the mid-seventeenth century, we understand that it would be more convenient to characterize it as a *Natural and Experimental Philosophy*.

Symposium (Part 1/3) Professional lineages and the pursuit of astronomy in medieval and early modern India (CHAMA) - ID 175

Contribution ID: 399
The Parvadvayasādhana of Mallāri: A Sanskrit table text to compute eclipses

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The *Parvadvayasādhana* (``Computation of the two syzygies") of Mallāri (fl. late sixteenth century) is a short treatise dedicated to the computation of lunar and solar eclipses. Composed in 1588, the work is

said to be extant in at least 25 manuscripts. What is particularly significant about this composition is that Mallāri belonged to the prominent kin-school, an influential family of astronomer-mathematicians working in central and northern Indian in the mid-second millennium, following the compositions of Gaṇeśa. We explore the significant features and relationship of this work to others produced by this family tradition.

Contribution ID: 321

Gaṇeśapakṣa: the Grahalāghava of Gaṇeśa Daivajña and its commentaries by Mallāri and Viśvanātha

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Gaṇeśa Daivajña (b.1507 CE, Nandigrāma, India), the son of respected astronomer Keśava, composed a technical *karaṇa* (astronomical handbook) *Grahalāghava* (1520 CE) that described clever formulas for astronomers to use while making planetary calculations without the canonical trigonometry. This "scholastic trademark" was one of the key characteristics of Gaṇeśa's professional and familial lineage, called the *Gaṇeśapakṣa.* Gaṇeśa taught Divākara (Golagrāma, India), and his sons Mallāri (1602 CE) and Viśvanātha (about 1612 CE), who became illustrious members of the *Gaṇeśapakṣa*. Mallāri and Viśvanātha composed commentaries to highlight underlying theories and derivations that are not otherwise mentioned in the *Grahalāghava*. Several questions arise when comparing the theoretical commentarial style of Mallāri to the example-ridden commentarial style of Viśvanātha: what computational and explanatory techniques do they use, and how much information do they presume of their target audiences? In this talk, I will use specific examples of commentarial rhetoric to illustrate the different yet complementary relationships between the *Grahalāghava* of Gaṇeśa Daivajña and its commentaries.

Contribution ID: 414

From complements to critiques: the culture of astronomy in Kāśī of the seventeenth century

Anuj Misra
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Taking a stroll along the ghats of Kāśī (Varanasi) today, one encounters the profound and the profane sharing the same space. In the seventeenth century, much like it is today, the eternal city was home to many men from many places who spoke in many tongues. Kāśī's gift to them was its openness to allow the sacred and the secular to thrive. In the story of Sanskrit *jyotiḥśāstra*, we encounter two families of immigrant Brahmins who came to Kāśī from different places, and then went on to enrich Kāśī with their different opinions. Munīśvara (from the family of Devarātra Brahmins who emigrated from Dadhigrāma on the Payoṣṇī) and Kamalākara (from the family of Bhāradvāja Brahmins who emigrated from Golagrāma on the Godāvarī) were two prominent seventeenth-century astronomers who held rather different views on the doctrines of the Pārasīkas (Persians). What ensued was a thriving discourse that roped in members of their extended families and provided Sanskrit *gaṇitajyotiṣa* (mathematical astronomy) with some of its finest moments of intellectual polemics. In this talk, I describe these actors

and the ways in which they refute and reconcile ideas, particularly, the language with which they compliment or critique each other.

Contribution ID: 333

The Gūḍhārthaprakāśikā of Raṅganātha and its significance

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Among the classical texts on Indian astronomy, it is the *Sūryasiddhānta* that has the largest number of commentaries. One of the oldest and brilliant commentary on this text is by Raṅganātha (Śaka 1495) called the *Gūḍhārthaprakāśikā*. At the end of his commentary Raṅganātha states that this commentary got completed on Śaka 1525, i.e. 1603 CE, Caitra month śukla ekādaśī the day on which his son Munīśvara was born. It is extremely rare to find commentaries that integrate this kind of personal details along with the date of completion of the work.
Munīśvara, in his commentary Marīci on *Siddhāntaśiromaṇi*, while describing Raṅganātha (his father) uses the phrase `*triskandhapāraṅgamaraṅgamalla*' (the best among the wrestlers of Jyotiṣis who have mastered all the branches of Jyotiṣa). This epithet amply brings out the outstanding scholarship of Raṅganātha. At the outset of the commentary *Gūḍhārthaprakāśikā*, Raṅganātha also indicated that extraordinary efforts have been put in writing this commentary.
During our presentation, we shall try to demonstrate how the title to this commentary (meaning that which throws light on subtle ideas) gets justified. Interestingly, the scholarly lineage has continued as Raṅganātha's son Munīśvara has composed texts like *Siddhāntasārvabhauma* with an auto-commentary, an elaborate commentary on the *Līlāvatī* by the name *Nisriṣṭārthadūti*, a commentary on *Siddhāntaśiromaṇi* called Marīci and also another independent work *Pāṭīsāra*.

Session XV (Part 1/2) - Chemistry

Contribution ID: 1119

Philip II and the hispanic early modern empire: alchemy and natural history at Potosi

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The Early Modern Hispanic World is giant. Philip II reigns over an empire where the Sun never sets, to maintain the stability of this territory the need for money is huge. The mines of Potosi are the most important answer to this necessity, the mountain produces up to 60% of the silver global production of the second half of the 16th century. The discovery and the exploitation of the mines depend, at first, on indigenous people and their technics, especially traditional instruments such as huayrachinas and toccochimbos.
During the 16th century, Natural History becomes a discipline on its own, its practitioners establish rules and create a community. In the frame of this discipline, alchemy becomes the branch dedicated to the inanimate: plants and minerals. The self-empowerment of Natural History and of its branches allows the inclusion of Early Modern Spain in the historiographical current of the Scientific Revolution.
Most Hispanic natural historians are not giants, the metallurgists get dwarfed because of the necessity of keeping secret the methods of the purification of silver, medical doctors hide behind traditions and

censures, botanists just start their differentiation. Nevertheless, the alchemical work, in metallurgy and medicine, done in the Hispanic World is very important in the scholar landscape of the Early Modern era, the purification of metals and the massive production of mineral and plant-based remedies are crucial points of the advent of Modern Science.

Contribution ID: 1091

Iatrochemistry movement at ottomans

ilknur şahin
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Iatrochemistry can be thought as a movement that is between alchemy and modern chemistry era. Iatrochemistry had started with Paracelsus at West and then spreaded to the Ottomans with Bursalı Ömer Şifai at 17th century. After Bursalı Ömer Şifai, his student Bursalı Ali Münşi and other scholars follow this movement until 19th century. Modern chemistry era had started with Derviş Paşa (1813-1879) at Ottomans and until that time iatrochemistry is used for both chemistry and medicine at Ottomans between 17-19th centuries, since it has seen as a transition stage. At 19th century, there are many scholars who study on chemistry and medicine at military and medicine schools at Ottomans. These scholars studied especially on biochemistry and inorganic chemistry because of military and medical reasons. In this paper, it will be studied on the iatrochemistry movement at Ottomans between17-18th centuries. It will be handled in historical context and then compared in terms of West and East science.

Contribution ID: 1169

The tantalum metals and the attribution of elementary status in nineteenth-century analytical chemistry

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Following the chemical revolution and throughout most of the nineteenth century, Lavoisier's definition of chemical elements as operationally indecomposable substances was widely accepted in chemistry. Yet, when determining whether or not a substance could be considered an element, chemists regularly made exceptions to the Lavoisierian criterion of chemical simplicity. In this talk, I analyse one such example: the debates surrounding the elementary nature of tantalum, niobium, and three other 'tantalum metals'. Because of the difficulties of distinguishing between constituent elements in mineral analysis, this group of metals remained controversial for almost seventy years. I argue that the determination of their elementary nature relied on the behaviour of their compounds: in order to claim discovery of a new metal, one had to identify its oxides and show how to distinguish them from other metallic oxides. It was not evaluated whether the new element was the last point of a chemical decomposition, since chemical analysis mostly did not proceed via decomposition. Using the case study of the tantalum metals, this talk illustrates the need to study the ways in which substances were judged to be elementary in practice in order to increase our understanding of the history of the concept of element.

Symposium (Part 4/6) Transportation History: Canals and goals of civil engineering (ICOHTEC) - ID 526

Contribution ID: 788

Navigation canals in Spain. Territorial and ideological impact of a utopia

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Sixteenth to nineteenth century Spain was home to canal building projects that pursued the navigability of some of the country's rivers. The Spanish monarchy's global reach and its political ambition determined the extraordinary magnitude of some of those initiatives, comparable to others underway in the rest of Europe. Engineers and architects, resources and solutions from a variety of geographies were enlisted, with an occasional attempt to send them on to the monarchy's American possessions.
More than the territorial, economic and cultural impact (which in some cases was so deeply felt that it is present even today) of the works ultimately completed in Spain, the paper pivots around the kind of society such projects were expected to inspire. Navigable canals and rivers were to build a new, desirable country. The dreams and promises associated with those works are deemed to be determinants for understanding their social and cultural significance. In Modern Age Spain, the progress predicated upon such infrastructures was essential to driving the administrative and technical reorganisation of civil engineering. At the same time, however, the projects never undertaken and the absence of the anticipated consequences brought frustration and political tension that came to a head in the nineteenth century with the collapse of Spain's 'Ancien Régime'

Contribution ID: 762

The Industrial Canals: From Transport Routes to Leisure, Cultural and Environmental Corridors. Regent´s Canal, London

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During the 18th and 19th centuries, an extensive network of canals was created in Europe, which forms the basis of the current system. Its development led to more regular and safer transport. This canal network has built and connected territories, where confluence places of exchange and commercial routes formed focal points of activity and urban growth.
Faster and more efficient transport technologies have been replacing the canals. Firstly, the railway and later the proliferation of the automobile, made them no longer useful for that purpose. In the cities, some of them were replaced by new roads (e.g. Milan - Cerchia Interna dei Navigli), others were preserved with irrigation and supply uses (e.g. Zaragoza - Canal Imperial) and in England some were derelict, becoming both urban and social problematic areas.

However, over the last decades, the international scene about waterways has substantially changed. They have acquired broader values and uses beyond their initial function, turning into focal points of revitalization and urban development.
Drawing from the Regent's Canal case, the aim of this paper is to analyse the problems faced by the urban industrial canals and how they can become a support for the new city challenges in their process of growth and transformation, through their regeneration.
Keywords: industrial canals, obsolescence, use change, urban regeneration, new values

Contribution ID: 841

The British vs. the French: Rival Traditions in the Planning of American Canals and Railroads, 1800 to 1869

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At the close of the Napoleonic wars, as the United States came of age as a builder of canals and railroads, engineers looked to France and British for two very different approaches to transportation planning. Francophiles advocated a public system of grand canals, tax-funded and monumental. Anglophiles preferred the flexibility of bank-financed water and rail projects. Americans by the 1830s had learned to borrow from both traditions. U.S. army engineers, schooled at West Point, returned from Paris with elaborate justifications for centralized state-of-the-art navigation projects. The builders of New York's Erie Canal, by contrast, had been field-trained craftsmen who looked first to London for capital and inspiration. Britain more than France had inspired America's first mountainous railroads. Paris more than London had influenced the streets and canal engineering of Washington, D.C. Engineering was also politics. France centralization grated against British-style transport planning in America's explosive debate over the need for construction regimentation to override local control. By the time of the U.S. Civil War, in public-private projects such as the great transcontinental railroad, Americans mixed traditions. Remnants of Europe elsewhere survived in Boston's lighthouses, the floodways and barge channels of the Ohio-Mississippi, the Brooklyn Bridge, and the ports of St. Louis and New Orleans. A lively slide presentation highlights the traces of Europe in icons that historians have come to regard shining examples of American pride.

Contribution ID: 712

Technological continuation and innovation: three super combined bridge of the Qiantang River and the Yangtze River, 1935-1969

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As China features complicated topographies and boasts a vast number of rivers and lakes, the construction of railway bridges has been playing a significant role in the development of railways in China. During 1930s, Mao Yisheng, Luo Ying and Chinese engineers successfully designed and constructed the famous Qiantang River Railway Bridge for the Zhejiang-Jiangxi Railway. By the first half of the 20th century, the Yangtze River, the longest river in China, had still been a natural obstacle to the

extension of railroads in the country. The Wuhan Yangtze River Bridge and the Nanjing Yangtze River Bridge, which were built between 1950s and 1960s, connected the Guangzhou – Wuchang Railway with the Beijing – Hankou Railway, and the TPR with the Shanghai – Nanjing Railway respectively. For building the Wuhan Yangtze River Bridge (1,670m), Mao and Luo made use of their experiences gained in building the Qiantang River Bridge and tried to apply such technologies as the pneumatic caisson method again. However, Konstantin Sergeevich Silin (Константин Сергеевич Силин), one of the experts assigned by the Soviet Union to aid China at the time, recommended the Chinese to apply the more advanced tubular column drilling method, with which the construction of the Wuhan Yangtze River Bridge succeeded. The Nanjing Yangtze River Bridge (6,772m), which is longer than the Wuhan Yangtze River Bridge, further applied the construction method of the Wuhan Yangtze River Bridge straightforward, and further developed a new tubular column method.

Session XVI (Part 1/5) - Medicine

Contribution ID: 1177

Avicenna's Cardiac Drugs transmitted: an examination of Quṭb al-Dīn Shīrāzī's commentary on Avicenna's Canon of Medicine

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The situation of Islamic medicine in the post-Avicennan era is vague. What is known is that Avicenna's medical theory continues its influence through the commentaries on his works. We know commentaries on Avicenna's *Canon of Medicine* by several scholars, among whom is Quṭb al-Dīn Shīrāzī, a scholar who was active in today's Iran in the 13th to 14th centuries. How does the influence of *Cardiac Drugs*, a medical treatise by Avicenna? The treatise is important in that it demonstrates Avicenna's views on the human spirit more precisely than his *Canon of Medicine*. Presently, a commentary specific to the *Cardiac Drugs* is unknown, so it is difficult to assess the influence of the work. An examination of *al-Tuḥfah al-saʿādīyah*, Quṭb al-Dīn Shīrāzī's commentary on Book One of the *Canon of Medicine*, reveals that Quṭb al-Dīn Shīrāzī refers to the title of *Cardiac Drugs* and uses its contents to explain the passages of the *Canon of Medicine*. In this paper, I address some accounts of Quṭb al-Dīn Shīrāzī's commentary on the *Canon of Medicine*, and I analyse those accounts to show their derivation from Avicenna's *Cardiac Drugs*. I then suggest that the further investigation of other commentaries on the *Canon* reveals the transmission of the *Cardiac Drugs* in post-Avicennan Islamic medicine.

Contribution ID: 1099

The scientific subject in the middle ages: eyeglasses, scribes, and ways of seeing

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Giants among scientific research, microscopes and telescope have long held the attention of historians and scientists alike as the pivotal optical technologies that changed not only scientific practices, but scientific subjects as well. This paper considers the role of eyeglasses, an optical dwarf by comparison, and its role in producing scientific subjects throughout the Middle Ages. The relationship between the Church and Science in the mid to late Middle Ages is one of intricate influences. But, as the Church was the primary producer of manuscripts before the introduction of the printing press, and patron of schools

across Europe, its role as an investigative power cannot be understated. By tracing the history of glasses within the church, including distribution and sales, and the role of the technology in the life and labour of the scribe, this paper addresses the impact of the optical media in scientific knowledge production, circulation, and consumption between the 1200s and the 1500s. Using media genealogy as the primary method of analysis, this project considers eyeglasses as the imagined solution to the perceived problems of human visual information processing, and the consequences of its use on information behaviours.

Contribution ID: 1111

Bungler or Pioneer: Did Johann Dryander Forestall Vesalius in Brain Anatomy?

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Between the vast eras of the middle ages and modern times, we normally define a comfortably wide zone, the Early Modern Period, for transition. Yet, there often arises a need to draw a definite line when "old" tipped over to "new," and in the history of anatomy that was the year 1543, the publication of Andreas Vesalius's *De humani corporis fabrica*. However, when celebrating the pioneer character of the *Fabrica*, when emphasizing its novel comparative approach in dissection, and identifying it as the initiator of empirical science in physiology, do we not overshadow a whole slew of other anatomical works of the time that, at least in part, did the same?
Recent research for a *Vesalius and His Age* exhibition in the Smithsonian revealed that Johann Dryander's head dissection illustrations in his *Anatomia capitis humani …* well preceded Vesalius famous, and very similar, images in the *Fabrica*. Dryander's 1536 work turned out to be one of the earliest anatomies with woodcuts after the author's own dissections. He also published a full-scale human anatomy in 1542, one year before the *Fabrica*! Accusations of copying some original drawings and the cruder style of the Dryander woodcuts naturally raised questions around the issue. But it is unquestionable that Dryander was a precursor of Vesalius by several years in publishing descriptions and depictions of brain anatomy.
The paper will draw attention to the problem that historiography often declares "giants" *necessarily* central figures of a major change neglecting the complementary lesser-known contributors and their indispensable work.

Contribution ID: 1181

Maurício Oscar da Rocha e Silva: pharmaceutical research and its institutionalization in São Paulo – Brazil (1934 - 1942)

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This presentation analyzes the institutionalization of pharmacology in São Paulo between 1934 and 1942, emphasizing the strategies and controversies that made this institutional input possible. Our approach follows the first twelve years of *Maurício Oscar da Rocha e Silva* - a distinguished Brazilian physician - scientific experiences. He was known for being involved on the discover of *Bradykinin* (1948) and to have participated on the foundation of important scientific associations, such as the Brazilian

Society of the Progress of Science (1948) and the Brazilian Society of Pharmacology and Experimental Therapy (1966). Indeed, the pharmacological researches began to take place on the Brazilian scientific community in these places.
By analyzing the first twelve years of Rocha e Silva's career, we present the strategies and networks of allies by which this scientist was introduced on the scientific field. On the beginning of his career, in 1934, he started to work in the *Instituto Biológico* (São Paulo, Brazil), where he was nominated head of Biochemistry and Pharmacodynamics' Division in 1942. In the meantime, this scientist also invested on his international career, publishing articles about the role of histamine on inflammatory reactions, and participating of the III International Congress of Microbiology held in New York (1939), with the partnership of Otto Bier. Therefore, we propose that the scientific experiences of Rocha e Silva help us to understand how pharmaceutical research started to have institutional support in Brazil, and how the establishment of this field involved the constant debate with foreign researchers and institutions.

Session XVII (Part 1/2) - Science and Philosophy

Contribution ID: 1088

The asymmetric model of the relation between the history of science and the philosophy of science

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The most popular model of the relation between the history of science and the philosophy of science was proclaimed by I.Lacatos in his "History of Science and its rational Reconstructions": "Philosophy of science without history of science is empty; history of science without philosophy of science is blind". This model is symmetric. The asymmetric model of the relation between the history of science and the philosophy of science was developed by T.Kuhn, who claimed that the history of science must be autonomous discipline and that the philosophy of science could not help much historian of science. I'm going to reveal the historical context of this conflict between two models and present some arguments in favor of the asymmetric model. The modern state of this conflict I would like to present referring to the scientific realism – antirealism debate. I argue that the main trouble for the modern philosophy of science is the threat of it's scholastization. In order to prove numerous arguments pro and contra scientific realism or antirealism, philosophers of science develop many "artificial" interpretations of the history of science that really could disorient professional historian. This strategy doesn't enrich the number of relevant historical interpretation of science or help us to recognize new actual historical contexts. That is why T.Kuhn point of view is actual nowadays and the history of science must be autonomous discipline.

Contribution ID: 1172

Issues of evaluating the significance of Late Medieval Natural philosophy

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In the scholarship of Late Medieval Natural philosophy, the interest in proper explanation and understanding has been a major driving force for the development of the field since the middle of the

twentieth century. Despite the continuous pursuits by Maier (1940), Murdoch (1975), Goddu (1993) or Grant (2011) to evaluate the epistemic significance of scholastic theories from the conceptual standpoint of their , new standards for their epistemic justification have been emerging in the field recently. In Klima's work (2017) it is argued that the recent scholarship "endeavours to bridge the linguistic and conceptual gap between mid-fourteenth century Paris and today". *Rediscovering* Buridan, and also *recovering* his thought for contemporary philosophy, advances our historical understanding of philosophy in the later Middle Ages and sheds a fresh light on "some of our most recalcitrant contemporary predicaments" (Klima 2017: vi). I aim to challenge the latter notion arguing that it is non-scientific. By contrasting Roth's (2020) and Boulter's (2019) approaches to historical explanation with postpositivist ones by Fain (1970) and Lakatos (1970), I am bringing issues concerning the scientific status and utility of the medieval scholarship to the fore.

Contribution ID: 1093

Collaboration of Polish Logicians with Heinrich Scholz and "Group from Münster" (1932-1956)

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In Sammlung Scholz (Universitäts- und Landesbibliothek Münster, Münster, Germany) there are plenty of documents (mainly letters) of collaboration between Polish logicians and the so-called "Group from Münster", established by Heinrich Scholz (1884–1956). They collaborated with: Józef. M. Bocheński, Stanisław Leśniewski, Jan Łukasiewicz Andrzej Mostowski Jan Salamucha, Jerzy Słupecki Bolesław Sobociński, Alfred Tarski and Mordchaj Wajsberg.
The "Group from Münster" wrote that Łukasiewicz and Leśniewski first discovered value of Gottlob Frege's logic.
Their correspondence can be divided into three parts with respect to the Second World War: before, during and after. The following topics were raised there:
1. The Scholz's visits in Poland before the war, his help to Polish academics during the war; Polish logicians who survived the war and their post-war activities.
2. Organization of scientific environment, didactic activities, duties (academic and non-academic research), scientific trips.
3. Current research topics, prospects for post-war publications and future publishing plans.
4. Personal matters, Scholz's health problems in particular.

This subject has been only partly known and only a few letters have been published until now. These giants' collaboration needs in-depth research.
References
Peckhaus V.: *Heinrich Scholz*. In: *The Stanford Encyclopedia of Philosophy.*
Schmidt H.-Ch. am Busch, K.F. Wehmeier: *On the Relations between Heinrich Scholz and Jan Łukasiewicz*. „History and Philosophy of Logic" 2007.
Schreiber P.: *O związkach Heinricha Scholza z logikami polskimi*. In: *Matematyka Polska w stuleciu 1851-1950*, 1995.
Schreiber P.: *Über Beziehungen zwischen Heinrich Scholz und polnischen Logikern*. In: *Mathematik im Wandel*, 1998.

Symposium Assistive technologies, (dis)ability studies, and public health (ICOHTEC) - ID 200

Contribution ID: 258

From fluorescent gloves to closed-captioning. The deaf American's struggle for civil rights

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As Emerson Romero, a deaf silent film actor, who had to leave the film industry after sound was introduced in late 1920s, said: if the deaf want to have something done – they have to do it themselves. It proved to be right in the case of the American deaf struggle to maintain access to moving pictures after film industry switched to talkies.
They unsuccessfully tried to persuade the film companies to keep the silent movies production, by sending petitions and publishing open letters in the press. The silent film in the US ceased by the end of the 1920s. The deaf took up many bottom-up, fan strategies to gain access to cinematic entertainment, such as hiring sign interpreters and providing them with fluorescent gloves or creating silent-film style titles for sound films (inevitably destroying the film reels). The latter activity, initiated by Romero, started a process that turned subtitling films from DIY and volunteer activity into regulated by law, mandatory element of film and TV production.
In the presentation, film and TV subtitling, that moved from amateur practice to professional services, serve as an example that for minority communities access to entertainment technologies may be considered as struggle for equality and civil rights.
The paper is based on primary sources, mainly the American press for the deaf, and the collections of the Gallaudet University in Washington DC, which was actively engaged in lobbying for film subtitling, as well as a provider of the first subtitling services.

Contribution ID: 789

"Circumventive organs" and artificial tissues' designs. Around the inside-body prosthesis in bioartistic projects

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The main aim of the presentation is to introduce the issue of creating artificial organs and tissues in the selected contemporary art&science project. All of them examine possibilities and consequences of organs' and tissues' creation and transplantation in reference to the problem of disability and enhancement of (un)human organisms. In my presentation, I will refer to: the project of Agi Haines "Circumventive Organs", to the project created by Monté and Kiers "The Art of Deception" and to John A Douglas' video installation "Circles of Fire".
First of all, I would like to consider the artificial body parts as internal prosthesis. In ordinary life they are usually nonvisible, so they don't fit into the discourse of beauty and social exclusion caused by unnatural appearance. Therefore inside-body prosthesis are often located on the margins of disability

discussions. But, as projects in the area of engineering design, they instead carry an important question: whether our bodies can be a combination of separate parts that are independently enhanced, altered, regenerated or even donated? Could they exist outside the biological body as a form of semi-living beings who not only support our bodies, but also constitute separate 'entities' with which we co-exist? What is the social and cultural difference between first experiments with body prosthesis (firstly prosthetic device were used in Before Christ era) and innovative inside-body prosthesis, which became rapidly important part of bioengineering global market?
In my speech I will refer to the consideration contributed by: Ascott, Crabbe, Zurr and Catts.

Contribution ID: 958
When health became wealth: the Progressive Era and the economic foundations of public health in the United State

Michael Halpern
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In many countries, there is a focus on examining the "value" of medical care: that is, costs of medical care services, products, or interventions relative to their health benefits. In the United States, there is often resistance to considering costs relative to benefits for medical care; in some cases, this assessment of value is prohibited. However, this resistance is relatively new. The U.S. Progressive Era (1890-1920) was a period of societal reforms, with legislation empowering women, workers, immigrants, and the poor. During this period, reformers also argued for the benefits of improving health conditions for underserved populations. Building on earlier work on the "value of human life", public health professionals began to justify programs to fight mosquito-borne illnesses, improve water supplies, increase the safety of food and drugs, and screen for tuberculosis by demonstrating the economic savings of these programs relative to their costs. For example, during the U.S. construction of the Panama Canal, detailed cost calculations helped validate the health and economic benefits of programs to keep workers healthy; similar calculations were applied to many domestic public health activities. However, while this approach had wide acceptance in public health, even proponents expressed concerns about a "cold-blooded method of calculating the value of life and health in terms of dollars". This controversy remains today, with many U.S. government officials and policy makers reluctant to consider the economic cost of medical care relative to their value and difficulties identifying which health care services are truly "worth it".

Symposium (Part 2/3) Meteorological and magnetic observatories in the 19th century - ID 278

Contribution ID: 459
The Toronto Magnetic Observatory as an initiator of scientific work in Canada

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Established late in 1839, the Toronto Observatory was a vital part of the Magnetic Crusade. Observations made under the direction of John Henry Lefroy from 1842 to 1853, were essential in connecting geomagnetic activity to the solar cycle. This was the first time that a facility in British North America made substantial contributions to international scientific understanding.
After the British military abandoned the observatory in 1853, Canadians were able to secure modest government support for its continuance. The Toronto Observatory thus became a nucleus of scientific work leading into the early years of nationhood beginning in 1867. It led to scientific cooperation with the United States. It became the headquarters of a Canadian meteorological service in 1871 and, after acquiring a 15-cm refractor telescope in 1882, the national focus for observations of the transit of Venus and some subsequent astronomical work. Seismological equipment was added in 1897, marking the beginning of the scientific study of earthquakes in Canada. The late science historian Richard Jarrell saw the continuing role of government in science as a feature that contrasted Canadian from American science.
The observatory structure itself was dismantled and reconstructed in 1908, the telescope is now in museum storage, and the work that was initiated within its walls has moved on to other locations. While the Toronto Observatory was the locus of many initial steps in Canadian science, its history has been marked by close calls and shoe-string budgets, another trend that continues in some respects.

Contribution ID: 647

The visit of emperor of Brazil, Pedro ii, in 1872 to the meteorological and magnetic coimbra observatory: contributions to an archaeology of a scientific space

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CITEUC, DM, University of Coimbra, Coimbra, Portugal

On March 5, 1872, Pedro II (1825-1891), Emperor of Brazil, paid a lengthy visit to the Meteorological and Magnetic Observatory of the University of Coimbra (MMOUC). The Emperor was a man of culture and science, a particular enthusiast of natural sciences, who described himself as "born to devote to culture and science". Thus, a visit to Coimbra University, the only one in Portugal and with strong traditions in welcoming and teaching the Brazilian elites who crossed the Atlantic to graduate, would be one of the points of interest of his voyage to Portugal. The MMOUC set up in 1864 was one of the most recent scientific institutions in Portugal, and the Emperor's curiosity for it was both great and noticeable. Amazed with the location and the building, the Emperor wants to know all about the observatory's organization, the type and use of the instruments and its practice. Jacinto de Sousa (1818-1880), MMOUC's director, was the host who offered the Emperor with comprehensive explanations and descriptions. The report of the Emperor's visit, together with a set of descriptive MMOUC´s memoires, written between 1865-1893, allows us to understand the evolution and organization of space, the working of the instruments and the practices and scientific dynamics of MMOUC. They are privileged tools for an archaeology of the scientific practices and to address general questions in order to understand how places and spaces are relevant elements for research practices and, in the other side, how instruments/research practices were adapted to places.

Contribution ID: 738

Historical geomagnetic observations from Prague Observatory (1839 – 1917) and their contribution to geomagnetic research

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Regular magnetic observations at the Prague Astronomical Observatory were established by Karl Kreil on 1st July 1839. The observatory was equipped with standardized instruments developed by Gauss and Weber in Goettingen. The observations were carried out manually, initially more than ten times per day but later the number of observations decreased to five or even three per day. More frequent measurements were, however, carried out during strong magnetic disturbances.
The results were printed in yearbooks Magnetische und meteorologische Beobachtungen zu Prag. As the oldest geomagnetic data have been recognized as an important source of information for (not only) Space Weather studies, the Institute of Geophysics launched a program of data preservation. All volumes have been scanned and time series of declination and horizontal component were digitized and reprocessed. In the yearbooks the variation data from 1839 to 1871 had been published in dimensionless divisions. In their transformation to physical units one must take account of lower data stability and resolution in comparison with later magnetometer generations and unexpected errors due to the missing skill in this new branch of science.
The data were used for calibration of sunspot numbers by Wolf from 1850. Recently the data have been used for analysis of historical magnetic storms and for derivation of IDV index, which is a proxy of interplanetary magnetic field.

Contribution ID: 880

The first instruments of the Meteorological and Magnetic Observatory of Coimbra: the standard barometer of Welsh

Paulo Ribeiro
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The Meteorological and Magnetic Observatory of the University of Coimbra (MMOUC) was founded in 1864 in response to the scientific innovation and steady movement to create observatories dedicated to the investigation of Meteorology and Terrestrial Magnetism, which had been animating the most scientific nations since the second quarter of 19th century. Leading this significant project in Coimbra was Jacinto de Sousa (1818-1880), director of the Physics Cabinet, who after mission in 1860 to several European scientific establishments received the trust and support of the University and the King.
The construction of MMOUC closely followed the architectural design and operating model of the distinguished English observatory of Kew, as it was here that Jacinto de Sousa got the enthusiasm and assistance to build and calibrate the first meteorological and magnetic instruments that would come to equip the observatory of Coimbra. One of the most important and emblematic meteorological instruments imported from England was the standard barometer designed by John Welsh (1824–1859) for the Kew Committee of the British Association.
The Kew standard barometer, as became known, was installed on the south wall of the Coimbra observatory's barometer room, with which other instruments could be compared. With its large column of mercury and cistern and the auxiliary cathetometer for high precision observations, the barometer survived more than 150 years on the same wall and is now a rare object of musealization. This

presentation aims at giving an overview of its history and role in the meteorological science in the 19th century.

Symposium IUHPST essay prize lecture and presentation (DLMPST Joint Commission (JC)) - ID 315

Contribution ID: 1326

Misinformation age: What early modern scientific fakes can tell us about today's online fabrications

Marlis Hinckley
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Symposium The History of Artificial Intelligence (AI) and Robotics in Germany (ICOHTEC) - ID 1318

Contribution ID: 1319

Histories of Artificial Intelligence (AI) in Germany

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Internationally, the fields of automated deduction, natural language processing, and image processing emerged in the 1950s and were partially adopted by cybernetics, information theory and artificial intelligence (AI). It then needed the initiative of several young researchers active in these fields to establish an AI community. A similar process took place in West Germany about twenty years later, during the 1970s. This West German scientific community later experienced a shift in focus, partly due to international political and economic influences, towards research into expert systems, which dominated AI during the 1980s. While this field was emphasising technological applicability, a parallel strand of research, cognitive science, focused on understanding natural intelligent systems.
Thus AI was and is an umbrella term for an interdisciplinary field using methods and theories of the natural, engineering, and social sciences as well as the humanities. Looking at several AI research areas, we explore their initial conditions and varying origins in the Federal Republic of Germany. Our exploration is inspired by the earliest Studien- und Forschungsführer Künstliche Intelligenz (suggested curricula for AI and overview of institutions, 1983) which suggested a number of sub-fields. These include the above mentioned areas, as well as robotics. Given the recent nature of this field, we not only use archival and literature studies but also conduct oral history interviews with pioneering scientists. In our talk we offer a first sketch for the emerging histories of West German AI research.

Contribution ID: 1321

From Syntelman to Rotex – or the birth of autonomy

Frank Dittmann
Deutsches Museum, Munich, Germany

In 1970, the German engineer Hans Kleinwächter presented a telemanipulator designed to help humans moving in hostile areas or work in extreme environments in particular for maintenance and rescue work in nuclear facilities. Syntelman consisted of a control panel and a robot unit with two grippers and a stereo camera system. Both units were able to exchange information over long distances. The cameras provided a 3D shoot of the robot's movement in the environment and the operator steered the machine arms and grippers via an exoskeleton.
The German Space Agency bought Syntelman as technological platform for a robotic arm. Soon it became clear that the transition time of signals from Earth to the spaceship and back prevented a direct feedback between the operator by observing a screen and the telemanipulator. To solve this problem, researchers at the German Space Agency developed the idea of (partial) autonomy. The robot should be given a global target and a computer close to the manipulator should control the detailed hand movement by using a lot of data from a variety of sensors. The system received a limited autonomy. The result of the research, the ROTEX experiment, was tested on the space-shuttle mission Columbia in 1993.
In the literature on the history of robotics, the development of the concept of autonomy is a desideratum. The paper discusses the thesis that autonomy does not originate in the idea of the so-called strong AI, but is the result of work on specific problems on the technical level.

Contribution ID: 1323

Comment on the Symposium's Papers by Stefan Poser and Discussion on Robots and AI

Frank Dittmann
Deutsches Museum, Munich, Germany

The Discussion will be based on the IGGI Project of Deutsches Museum and linked a special issue of ICOHTEC's peer-reviewed journal ICON, which will be published in December 2021.
Robots where inaugurated as attractions of exhibitions in the 1930s, are employed in industries since the 1970s, and meanwhile they are on the way play an important role in service industries, too. Nowadays there is an intensive and controversial discussion on societal impacts of this development. In fact, this discussion has quite a long history, but now we might live in a decisive period for the inauguration of AI and robots – right time to shape future.
The discussion aims to analyze the history of robots and AI as well as the history of robots and AI discourses. Based on knowledge about history, the aim is to contribute to the ongoing discussion and to ethical guidelines for further development.

Symposium (Part 2/3) History of technology and museum business in XXI century. Information technology and computer science: heritage issues - ID 845

Contribution ID: 955

E-POSTER How myths are born: John V. Atanasoff, Mikhail Kravchuk, and Sergey Lebedev

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In recent years, in various publications in Russian, and not only in the Internet, but also in scientific journals, statements have begun to appear related to the design of the ABC electronic computer by American scientist John Vincent Atanasoff. They say, for example, that "Atanasoff, as a conscientious scientist, himself admitted that the mathematical basis of ABC computer was the ideas drawn by Soviet mathematician Mikhail Filippovich Kravchuk (1892–1942), who died in the Gulag". Some other go even further and attribute to Kravchuk no less than the creation of the first electronic computer project: "Ukrainian scientist, professor Mikhail Kravchuk created the project of the first computer in the world", "academician Mikhail Filippovich Kravchuk in Kolyma, being a political prisoner, was the first in the world who developed a theory of electronic computer" (!). Further assumptions are made that his work, in turn, gave impetus to the development of computers in the post-war USSR: "... there is the hypothesis about the existence of still undiscovered connection between the scientific heritage of Kravchuk, who worked in Ukraine, and the first Soviet MESM computer that was developed under the leadership of Sergey Lebedev in post-war Kiev".
This work examines the origin of these myths, analyzes their source — the articles presented by the American scientist I. Kachenovsky. It shows the inconsistency of the thesis about the influence of Kravchuk's work on the conception design of electronic computer by Atanasoff.

Contribution ID: 956

E-POSTER Timeline excerpts from the history of the Szeged IT collection

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Following events, objects and persons are connected to our IT collection. In 1946 Prof. Laszlo Kalmar became a head of department. He founded the KIBLAB UNI Szeged and IT school in 1963.
In 1965 M3M Soviet-designed and Hungarian-built computer arrived to Szeged. 1967–1975 was the MINSZK-22 transistor computer with very stable operation.
In the framework of the ESSR program, launched in 1969, two computers arrived at KIBLAB's computer center in 1974, Robotron R-40, and Videoton R-10. This was our TAF system with 55 terminals. We experimented with the original IBM DOS.
The collection was started by the NJSZT Tech Historical Committee/1977 and continued from 1992 by the ITMA Foundation. L. Kalmar get 1996 Computer Pioneer Award "For recognition as a developer of a 1956 logical machine and design of a MIR computer in Hungary". 1997 Exhibition opens in the former Soviet barracks (7000 items). In December 2011, the Science Museum of London hosted one of the

replicas of the Ladybird at Robotville Festival. 2012 Agóra NJSZT Exhibition opened "The past of the future" to protect the values of the past, to adapt to the present, to influence the future. In 2013 Honorary Guest of the Opening Hall of Neumann, daughter of J. Neumann, Marina von Neumann Whitman. 2013, KIBLAB50 was celebrated. ITSTAR 2014 conference held in Szeged. The Old Robot Ladybirds were on World Robot Olympiad 2019.
International Olympiad in Informatics 2023 future contest will be in Hungary, in Szeged.

Contribution ID: 957
E-POSTER Andromorphism in the language of computers: a short history

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As with most other technological developments, the advent of computer technology launched a full-scale assault on the English language. Words that enjoyed centuries of innocent meanings suddenly acquired a radical new technological slant: "bug", "browse", "copy", "pirate", "read", "write", "learn" (the list goes on considerably…) all acquired new meanings and scope. The extent to which this has happened in computer technology surpasses that experienced in any other new technology.
The anthropomorphic use of language is so pronounced in the computer world that the author has proposed the term "andropomorphism" for this subset (using the root of "android"). This double use of existing words leads to a straining of concepts — "owning" digital information is not the same as "owning" a car; "browsing" a library with extractive software is not the same as picking books off a shelf in a bookstore and flicking through pages… It is important to recognize that many of these andropomorphisms are metaphoric uses that do not necessarily represent — and often mis-represent — reality, producing a kind of fake news. This andropomorphism has now exploded in the language of artificial intelligence. This presentation will thus offer a short history of andromorphism from the birth of computers to the emerging technological horizon.

Session XIX (Part 1/4) - History of Physics

Contribution ID: 1008
Estevao Cabral versus Isaac Newton: a Portuguese critique on Newtonian theories of light and colors

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The reception of Newtonian doctrines outside Great Britain throughout the eighteenth century has been subject to various historical studies in the past decades. In Portugal, it is well discussed the gradual process of acceptance of Newton's ideas among Portuguese natural philosophers, especially after the reforms promoted by Marquis of Pombal in the second half of the century. In the case of optics, Newtonian theories of light and colors were favored by eminent natural philosophers, such as Teodoro de Almeida (1722-1804) and Jacob de Castro Sarmento (1691-1762). Nonetheless, there was produced a severe critique on Newton's optics – particularly on the projectile theory of light – by Estevao Dias Cabral (1734-1811), a Jesuit notable for his works in engineering and member of the Academy of Sciences of Lisbon. He wrote a memoir – undated, but probably written in the beginning of the

nineteenth century – where he described three major problems of the projectile theory and criticized Newton. He also favored a vibration theory of light and presented some experiments that, according to him, demonstrated that the idea of light corpuscles was not valid to explain them. This unpublished memoir is now in the archives of the library of the Academy of Sciences of Lisbon. In this communication, I present a detailed analysis of this memoir, in order to show that the reception of Newtonian optics in Portugal encountered at least one harsh critique, despite its general acceptance among Portuguese natural philosophers.

Contribution ID: 1143

Accuracy and error in Lord Rayleigh's teamwork

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Lord Rayleigh was undoubtedly a 'giant' of nineteenth-century physics, who made contributions in almost every area of the field during a career that spanned more than fifty years. Furthermore, his name became synonymous with exact experimentation and accuracy, a coveted epistemic value at the time. His fame had a lot to do with the experiments he carried out in the context of a project on the accurate determination of electrical standards. However, what Rayleigh and his research team meant by accurate measurements and the way they treated errors -both constant and accidental ones- in their experimental practice was neither straightforward nor common ground among contemporary members of the scientific community.
The way one dealt with measurement and error in the late 19th century was by no means universal. The distance between instrument readings and final measurement reports was considerable and with no single path connecting them. How that distance was bridged, especially in connection with the correction of constant errors, was also revealing for the relationship between theory and experiment.
The aim of this paper is to analyze 'accuracy' and 'error' in Rayleigh's work and to explore the various methods for the estimation of error and the evaluation of accuracy that were employed at the Cavendish Laboratory. I will argue that, as regards measurement and the treatment of error, even though research teams and scientific communities in Great Britain, France, and Germany interacted with their local national cultures, a differentiation along national lines cannot grasp the whole picture.

Contribution ID: 1058

Planck's constant in retrospect

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In 1901, Max Planck, doubtless one of the true Giants of modern Physics, summarized his epochal finds in a paper [1] entitled "Ueber das Gesetz der Energieverteilung im Normalspectrum". The message of the new, so-called 'quantum theory', was clear: black body radiation is a statistical phenomenon, in line with recent measurements by Lummer and Pringsheim. The paper closes with the introduction of a new natural constant, *h*, and its calculation, leading to a value of $6.55 \cdot 10^{-27}$ erg·sec. In 2018, on the occasion

of the centenary of Planck's Nobelprize, that constant, with a slightly adapted numerical value, was created the crux of the actualized *Système International [..]* [2]. Quite a career !
The centenary in question offered at once a nice occasion to reconsider Planck's procedure, since the overall line had never been revealed in all details. On the occasion of the centenary, we published a tentative solution of the riddle involved, a solution which links Planck's theoretical development with the kinetic theory of gases in its Clausius-Maxwell-Boltzmann format (*). Surely, there are some remaining questions to be answered, among which a discrepancy in numerical values. Work for a future Giant?
(*) 'A Tribute to Max Planck', in: *Europhysics News 49* (4) 27-30 (2018) [3].

[1] In: *Annalen der Physik 4* (4) 553-563 (1901).
[2] See: https://www.bipm.org/en/CGPM/db/26/1/
[3] See: https://www.europhysicsnews.org/articles/epn/pdf/2018/04/epn2018494p27.pdf

Contribution ID: 1075

Photography as a scientific tool in the study and medical illustration of the bubonic plague in Portugal (1899-1909)

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At the end of the nineteenth century, studies in bacteriology underwent great development. The use of photomicrographs as illustrations of Atlas and reports on bacteriology had a key role in the transmission of scientific knowledge in this field. This was partly due to the improvement of histological techniques and the reliability of scientific photography.
On July 1899, the city of Porto in Portugal was hit by an outbreak of the third pandemic of the bubonic plague. To determine the nature of this disease, bacteriological analyses and microscopic preparations of the bacillus were carried out under the direction of Ricardo Jorge, professor at the Medical School. Photomicrographs illustrate the report sent by him to the Portuguese health authorities. Portuguese medical dissertations and reports on the plague, published in this period, were also illustrated with photomechanical prints of photographs and photomicrographs obtained with the collaboration of professional photographers established at Porto, such as Emilio Biel. In 1908 there was another outbreak of the plague at the archipelago of the Azores, mainly in the islands of Terceira and Faial. Microscopic preparations of the bacillus were photographed at the Microbiological Laboratory at Porto but only at the end of 1908 was a medical mission sent to the Azores, so the difficult task of diagnosis and possible treatment of patients was ensured by the local medical doctors of the islands.
In this communication we examine the role of photography as a scientific document in the case of the bubonic plague outbreaks that occurred in Portugal.

Symposium (Part 2/2) Knowledge Cultures of the In-Between (Europe/East Asia): Mixtures, Communications and Ruptures in Material Cultures of Knowledge - ID 471

Contribution ID: 578

Therapeutic Trials of Prophylactic Alkaloids in British Malaya

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By analyzing archives of League of Nations (LON), and archival material of Institute for Medical Research (IMR) in Kuala Lumpur, this paper aims to reveal the therapeutic trials of prophylactic alkaloids in British Malaya. The discussion covers research and treatments of Malaria in British Malaya to the cooperation with the Malaria Commission of the Health Organization of the LON.
The Malaria Commission of the LON was searching an anti-malarial preparation cheaper than quinine but equally efficacious, compared with that of quinine, of a certain number of secondary alkaloid mixtures, such as Kinetum, Chineto, and cinchona febrifuge. In 1935, the Malaria Commission of the LON sponsored an international effort to determine the prophylactic merits of those alkaloids mixtures. The trials were made under conditions defined by the Commission, in Algeria, Sardinia, Romania, and Malaya.
The Malayan trials were carried out by IMR, on estates in State of Selangor where malaria was known to be severe. By confirming the interval and effect of prophylactic alkaloid mixtures, the dosage for Asians exposed to intense malaria had been defined.
Recent scholarship on histories of international health usually focused on international organizations like LOH or the Rockefeller Foundation, focusing on their financial influence and technical assistance to the colonies or the third world. Fewer studies have discussed the formation of networks within Southeast Asian countries to circulate the medical knowledge and technologies. Study of therapeutic testing of secondary alkaloids in British Malaya is providing a new perspective for probing the nature of international health.

Contribution ID: 579

Coca and cinchona: enacting the material relation in/between Taiwan and the globe

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Coca and Cinchona could be a very interesting comparative pair of case studies on the history of colonial medicine and materiality of colonial medicine. If materiality of medicine could be put in the context of 'enact the effective relation' as proposed by John Law, these two substances, coca and cinchona, crystalize a complex relationship between Taiwan and the globe. Geographically speaking, this relationship combines Taiwan and the Japanese empire, connects Taiwan and southeast Asia (especially Java, Malay and Philippine), and attaches the Japanese empire with European countries (especially Germany and Netherland) and South America (Peru and Bolivia). The agricultural and Forestry Experiment Stations in Taiwan play a very crucial role on enactment of these geographical relation. To study further on this enactment, I will, in this article, observe the following three pairs of keywords: purification and concentration (of the extraction of medicinal plants), output and cost (of the possibility of mass production), competition vs cooperation (within the international organization and market). The first pair of keywords could be related to chemical knowledge flow within the global network of medicinal plants, and the second one be referred to the technological knowledge practice within the related countries. The third one be involved the political-economic-social relation projected from the power relation of various countries within the League of Nation.

Contribution ID: 687

Medicalisation and its dependency on miracles and ruptures: Materialisations of drugs in South China (ca. 1870-1920)

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The effects of medicalisation in South China and Taiwan went beyond the realm of medicine, as the spread of Western medicine or allopathy also transformed the wider epistemic reconfigurations in the affected societies. In the backdrop of the feminist critique of science, which mainly focuses developments in Europe and North America, I assume that medicalisation in South China and Taiwan was also a crucial medium of Western epistemic patterns like the subject–object dualism, gender dichotomies, animal–human relations, and possessive individualism. Another effect of such medicalisation was the devaluation and overcodification of Chinese medical practices.
However, Western medicine did not diffuse from the West to the East in a passive manner. Medicalisation was a complex process that comprised heterogeneous agents like missionary hospitals, officers of the *Chinese Maritime Customs Service,* Japanese colonial medicine, and allopathic Chinese doctors, among others. The diverse agents that may have had different purposes and motiviations played together in a wider imperial assemblage that was not fully controlled by any of them.
Initially, the miracles of surgery played a decisive role in popularising allopathy in semi-colonial China. Around the turn of the century allopathic drugs gained in importance, which occasionally appeared to be elements of the materiae medicae of Chinese societies. My talk focuses the materialisations of drugs in the in-between of different assemblages of power and knowledge.

Symposium (Part 8/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 213

Contribution ID: 767

The catalogue of Lavoisier's collection: new light on an important 18th century collection of scientific instruments.

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Antoine Lavoisier, one of the most important scientists of the 18th century and generally considered the father of modern chemistry, had several large laboratories during his career. After his death, his collection of scientific instruments passed to his wife Marie-Anne Pierrette Paulze Lavoisier and was later enriched by various instruments of Lord Rumford (Benjamin Thomson), Madame Lavoisier's second husband.

After Madame Lavoisier's death the collection went to her heirs, the family de Chazelles. In 1837 some important artefacts were donated by Léon de Chazelles to the Académie de Sciences and eventually deposited with the Musée des Arts et Métiers. In 1952, after lengthy negotiations, the collection was acquired from the family by Pierre Du Pont, president of the famous chemical company, who donated it to the French state. Unfortunately, despite Lavoisier's importance and the early works of historians Douglas McKie and Maurice Daumas, the collection was never studied in detail nor the planned catalogue ever written. Several instruments were damaged, disassembled, or misidentified.
In 2017, after many years of trials and efforts, the prominent historian of chemistry Marco Beretta and I convinced the Musée to collaborate on a catalogue. For almost four years, we carefully studied more than 550 artefacts, cross-referencing with Lavoisier's works and archives and compiling a detailed scientific catalogue. All of the instruments were cleaned, photographed and if necessary re-assembled and restored by our skilful collaborators at the Musée. In my paper I will present the most important characteristics of Lavoisier's collection and illustrate the catalogue's structure.

Contribution ID: 283
Horace-Bénédict de Saussure (1744-1799): a pioneer of alpine measurement

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ABSTRACT
In this paper I will explore the Alpine research and instruments of the Swiss naturalist Horace-Bénédict de Saussure (1740-1799). He tirelessly crossed the Alps for almost 30 years to conduct various studies, although this was largely unknown at the time.
In August 1787, he made one of the first ascents of Mont-Blanc (4810m), a feat which has led to him being mistakenly considered the founder of modern mountaineering. But while the ascent helped to promote the Chamonix valley and Alpine tourism, Saussure's real goal was to find new clues supporting his theory on the formation of mountains and the origin of the Earth. Sick towards the end of his life, unable to conclude, Saussure finally left his theory unfinished.
Saussure was a man of the field who made the Alps his laboratory. He was one of the pioneers of Alpine meteorology and one of the first people to develop comparative measurements at different altitudes. A year after his Mont-Blanc ascent, he established a scientific camp on the massif at c.3300m above sea level, spending three weeks performing numerous climatic, atmospheric and meteorological measurements.
To carry out his mountain investigations, Saussure adapted and perfected existing instruments such as the barometer and thermometer. He also invented new instruments specially adapted to his needs such as the heliothermometer (solar radiation), hair hygrometer (humidity), magnetometer (magnetism), cyanometer (sky purity) and electrometer (atmospheric electricity). Many of these pioneering instruments are now kept at the Musée d'histoire des sciences de Genève.

Contribution ID: 1095
Ultramicroscopy in solid and liquid media – optical equipment to study nanoparticles prior to 1920

Timo Mappes[12]

[1]*Deutsches Optisches Museum (D.O.M.), Jena, Germany*
[2]*Friedrich-Schiller-Universität, Jena, Germany*

In 1903 Richard A. Zsigmondy (1865-1929) and Henry Siedentopf (1872-1940) jointly developed a new microscopical method to study the behavior of metal nanoparticles in solid and in liquid media: ultramicroscopy. By applying this new darkfield-setup, Zsigmondy observed and described the vivid colors of the Tyndall cones of moving nanoparticles in written text. Based on an antenna-model, he even speculated about the shape of the nanoparticles, depending on their spectral response. Eventually Zsigmondy was awarded the Nobel Prize in Chemistry in 1925 "for his demonstration of the heterogeneous nature of colloid solutions and for the methods he used" – this may count as the first Nobel Prize awarded for a microscopical methodology. This talk will introduce the microscopes and accessories developed for ultramicroscopy by Siedentopf and Zsigmondy. By applying original optical equipment of Zsigmondy's time and state-of-the-art technology for the characterization of a sample colloidal solution described by Zsigmondy, these historic experiments could be revisited and will be presented.

Symposium (Part 2/3) Professional lineages and the pursuit of astronomy in medieval and early modern India 2/3 (CHAMA) - ID 176

Contribution ID: 387

Some traditional astronomical teachings from Lalla to Bhāskarācārya through Śrīpati

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Use and adaption of previously established knowledge by the successive in their treatises and procedures is common in scientific traditions of civilizations. This is particularly true with regard to Indian astro-mathematical tradition since adaptive reuse is one of the fundamental features in it. In this process Indian mathematician-astronomers at times do not attribute their quotations and content being reused to their respective . But it is not impossible, in some cases, to trace how and through whom/ which this knowledge had been passed onto them. In fact, it is well-established that Śrīpati and Bhāskarācārya were apart approximately one century and that both are quite clear on their purpose and sources of the writings. According to their treatises, they both present the knowledge that had previously been invented and accumulated by their predecessors among whom Lalla is one. However, the generic opinion, Lalla's *Śiṣyadhīvṛddhidatantra* influenced the *Siddhāntaśekhara* of Śrīpati and the *Siddhāntaśiromaṇi* of Bhāskarācārya, is partially true. Our presentation intends to reinvestigate this claim and also show in particular that some of the traditional astronomical contents and teachings that is in the *Siddhāntaśiromaṇi* actually were not extracted directly from the *Śiṣyadhīvṛddhidatantra* but through the *Siddhāntaśekhara*. To that end, we will examine the content, the technical terms employed, and arguments posited, in the three texts and also the language and style used by the three astronomers.

Contribution ID: 402

Remarkable contributions of Muniśvara: Dadhigrāma's tail end astronomer

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Munīśvara (b. 1603 CE), the son of Raṅganātha, was an astute astronomer and mathematician who shined like a star in the long lineage of extraordinary scholars hailing a village called Dadhigrāma. Though Munīśvara appears at the tail end of the lineage, he was not a tailender. Through his works he has amply demonstrated his skills both as an author and a commentator. His *Siddhānta-sārvabhauma,* a text on astronomy, was composed in 1646 CE which has an auto-commentary named *Svāśayaprakāśinī* (1650 CE). Truly inspired by the works of Bhāskara (12th. cent. CE), Munīśvara wrote two brilliant commentaries on his works namely *Marīci* on *Siddhāntaśiromaṇi* and *Niṣṛṣṭārthadūtī* on *Līlāvatī*.
Though scores of commentaries and translations on the *Līlāvatī* are available, the *Nisṛṣṭārthadūtī* (*lit.* the emissary of the bestowed meaning) stands unique in many ways. In this commentary, apart from explaining the rules and examples in the original text, the author makes the reader engage with a variety of erudite discussions by way of providing demonstrations & proofs along with those provided by other mathematicians. Not only does he quote pioneers like Brahmagupta, Śrīpati, Āryabhaṭa II, etc., but also throws light on lesser-known scholars such as Lakṣmīdāsa, Rāmacandra, Sūrya Daivajña, Bālakṛṣṇa, Viṣṇu Daivajña, etc. During those extensive discussions, Munīśvara both compliments and critiques the views of these scholars. Furthermore, he exhibits his poetic genius, following the footsteps of Bhāskara. In our presentation, by citing a few instances, we would like to bring forth the extraordinary talent of Munīśvara as a commentator.

Contribution ID: 426

Mathematical-Astronomical works by Luṭfullāh and Khairullāh, son and grandson of Aḥmad Ma`mār, the architect of Taj Mahal

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I wish to deal with the astronomical mathematical works in Indo-Persian by Luṭfullāh Muhandis bin Aḥmad Ma`mār and by Khairullāh Muhandis bin Luṭfullāh. Aḥmad Ma`mār (d.1649) was actually the architect of Taj Mahal at Agra, the mausoleum of Emperor Shahjahan's Queen Mumtāz Maḥal. Both Luṭfullāh and his son Khairullāh had been well known astronomers and mathematicians. Khairullāh was appointed by Raja Sawā'-i Jai Singh (d. 1743) as the director of the Delhi Observatory built in 1724 - 1725. Luṭfullāh (d. 1682) authored 10 works, 5 each deal with astronomy and mathematics. Noteworthy is his Persian translation of the *Catalogue of Constellations* written in Arabic by the Iranian 'Abdul Raḥmān al–Ṣūfī (d.986). It was actually the second Persian translation, the first rendered by the Iranian Naṣīruddīn Ṭūsī in the thirteenth century. Khairullāh Khān (d.1748) wrote nine tracts. Noteworthy is his compilation of the *Zīj-i Muḥammad Shāhī* (*ZMS),* which replaced then the prevalent *Zīj-i Ulugh Bég*. It is an adaptation of Philippe de La Hire's *Astronomical Tables*, presented to Raja Jai Singh by the Jesuits in the 18th century — the first instance of the *reception* of European Astronomy in India. Its fame brought even an Iranian, Muḥammad 'Alī Mubashshir Khān to visit Khairullāh to learn its mathematics for writing

his commentary. To conclude, I am presenting some details of Luṭfullāh and Khairullāh astronomical works to appreciate the Medieval Indian scientific tradition.

Contribution ID: 514

The use of continued fraction technique among the works of Kerala astronomers

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A brilliant school of astronomers and mathematicians founded by Mādhava (c. 1340 – 1420) flourished in Kerala between 14th– 17th century CE. One among them was Putumana Somayāji, the author of *Karaṇapaddhati,* which explains the mathematical basis of the *vākya* system of computing the planetary positions. *Karaṇapaddhati* also describes a mathematical technique known as *vallyupasaṃhāra* which is a variant of *kuṭṭaka* method for solving linear indeterminate equation. This is used for obtaining the smaller multipliers and divisors for a ratio which represents the rate of motion of the planets etc. *Vallyupasaṃhāra* method of transforming the *vallī* (a row of numbers) is essentially the recursive process of calculating the successive convergents of the continued fraction associated with the ratio. During this talk, I would like to present the algorithm and rationale for obtaining an integer known as *khaṇḍa* which is used in the computation of longitude of Moon using *candra-vākyas. Khaṇḍa* (in days, also known as *Khaṇḍadina*) is an auxillary epoch close to *ahargaṇa* (number of civil days elapsed since the beginning of the epoch). On the day of *khaṇḍa,* Moon's anomaly would be close to zero at the sunrise. The rationale for obtaining *khaṇḍa* for any desired *ahargaṇa* is indeed an interesting mathematical problem.

Session XV (Part 2/2) - Chemistry

Contribution ID: 1056

Russian colloid chemist Weymarn's activity in Japan in 1920s

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Pyotr Petrovich von Weymarn (1879-1936) stated the von Weymarn law: Colloidal dispersions are obtained from very dilute or very concentrated solutions but not from intermediate solutions in 1906. The relative supersaturation ratio herein is defined by S=(Q-L)/L (where Q is the amount of the dissolved material and L is its solubility). He received the Peketov Award from the Russian Chemistry Society. After the World War I, he escaped from the subsequent Russian Revolution and came to Japan in 1921 via Vladivostok with the introduction of Kikunae Ikeda (1864-1936). Ichitaro Syoji (18xx-19xx), director of the Osaka Industrial Research Institute, employed Weimarn made a colloidal chemistry laboratory, and got the latest experimental equipment.
After working for about 9 years, he published about 130 papers in *Kolloid-Z.*, etc., on gold colloid, fibrous material, recycled silk, photographic emulsion, and rubber latex. The results have led to industrization through industry-academia-government collaboration.

Contribution ID: 1262

The Chemical Agent Monitor: UK-US technological collaboration in the 1980s

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This presentation is an analysis of the development of the Chemical Agent Monitor (CAM), a unique Cold War Defence technology that was later developed into civilian applications. CAM is unsurpassed as a personal nerve and mustard agent detector for soldiers in a chemically hostile battlefield and was first successfully fielded in the mid to late 1980s. It is based on gas-phase ion chemistry. Drawing on unique oral history sources as well as recently released documents from the National Archive in London, this study of CAM reveals rich, working examples of the Anglo-American scientific alliances based on strong personal relationships. It also shows how the challenges of translating the technology from a laboratory device to one that could be deployed effectively on the battlefield were addressed. Analysis of the development of CAM offers a divergent narrative from existing historical perspectives on the interaction of military and civilian innovation, the ways in which private industry and state laboratories collaborated, and the effectiveness of British technological innovation in the 1980s. CAM was rapidly adopted by military users and was given the Queen's Award for Enterprise: Innovation (Technology) in 1988. In addition, its success opened up a new field of scientific research and development, ion mobility spectrometry.

Contribution ID: 1151

Hierarchies of models: creating a normative framework for computational quantum chemistry

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The predictive power and reliability of quantum chemical models were the product of a historical process of negotiations, controversies, and understanding of the manifold uses of predictions. Many different procedures to model molecules were proposed. Out of them, three were the most influential.
John Pople reckoned that what was needed was models that were preserving the system's physical consistency and could be easily applied. His "Theoretical Model Chemistry" implied that every model was creating a virtual chemistry that could acquire predictive power if tested successfully against known experimental facts.
Self-taught in quantum chemistry, organic chemist Michael Dewar thought that any approximations, however outrageous, could be used if they lead to useful results. He insisted that the only valid criterion of a model is how well it works.
Quantum chemist Enrico Clementi tried to improve the accuracy of quantum chemical models, and his goal was to create a program that could solve a chemical problem from beginning to end.
As it turned out, there was not a single solution for everything. Every model carved out a niche within which it reigned supreme, and from which it assessed the value of the others. By this process, a normative framework of models was created that could cover broad areas of chemistry. This framework was not static. As computer power increased, every model enlarged its domain of applicability.
Therefore, a dynamic normative framework of models was the major outcome of computational quantum chemistry as a tool of chemical research in the early 1980s.

Contribution ID: 1205
The politicisation of hydroxychloroquine during sars cov-2 pandemic- making a giant of a dwarf

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The present pandemic was mired in controversy, especially regarding the use and efficacy of an old drug, hydroxychloquine. There were two reasons mainly pointing towards this event - one was the favorability of this drug by the politicians, and second was its availability and wide usage. Hydroxychloroquine, a popular drug used against malaria also made developing countries like India appear at an advantage with respect to their rich western counterparts. The drug attributed a sense of political superiority to any nation which was in posession of hydroxychloroquine.
The present paper will explore the politicisation of hydroxychloroquine especially with regard to its wider availability and historic usage. The paper will argue that the political stakes of hydroxychloroquine was enahnced deliberately to enable economic benefit that was easier to accrue in the present case. The paper will trace the usage of hydroxychloroquine for other diseases especially malaria in the developing countries, and how the increase in demand for hydroxychloroquine in the western economies, served as a power enhancing tool for the developing countries which found itself in good stock of this drug.
The paper will especially focus on the ban in exports of hydroxychloquine imposed by India to deal with the pandemic, which was later lifted by the pressures of the Trump administration. The paper will examine the question of power politics associated with this drug in the present pandemic.

Symposium (Part 1/2) Transnational entanglements in Cold War social science – ID 359

Contribution ID: 419
Cold War social sciences: Transnational entanglements

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This paper considers recent studies of transnationalism in Cold War social science (CWSS) in order to reflect on two central issues. The first one concerns classification and the challenge of establishing useful categories for identifying different types of CWSS. Recently, Nils Gilman has proposed such a classification in terms of four orders, from first-order cases where social scientists focused on "problems defined . . . as the elemental dimensions of the Cold War struggle," to fourth-order cases where social scientists "explicitly challenged the premises and presumptions of the Cold War." I will explain that though this typology is helpful, it also has certain limitations and these become especially clear in studies of transnational social science. Second, I will consider what recent studies of transnationalism have

revealed about the value of "Americanization" as a lens for understanding the trajectory of the social sciences during the Cold War.

Contribution ID: 513

Catastrophes, cross-cultural studies, and Cold War: The transnationalism of US-American "social science disaster research"

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During the Cold War, several US-American "social science disaster research" groups investigated the reactions of individuals, organizations and communities to "natural" and technological "disaster". In the 1950's they conducted field studies not only in the US but also in Latin America, and Europe, and promoted "cross-cultural" research. From the 1970's onwards, they also studied disaster behavior in several Asian "developing countries", and increasingly cooperated with colleagues from other Western countries. My paper provides a provincializing analysis of disaster research's transnationalism. As I will demonstrate, the work of US disaster research groups was deeply steeped in (neo)colonial structures and discourses, manifest not only in the asymmetrical (non)circulation of knowledge but also in the formation of research objects and in the organization of scientific practices. I will explore how disaster research was in this respect a paradigmatic case of Cold War social science, and of scientific knowledge production in the wake of Cold War liberal governmentality.

Contribution ID: 777

From Industrial Sociology to Social Planning: Sociology and Welfare Policies in Late Socialism, Czechoslovakia 1968-1989

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The era of state socialism is characterized by some scholars as welfare dictatorship or, using the original German notion authored by historian Konrad Jarausch, Fürsorgediktatur. In Czechoslovakia this characterization is plausible when considering last two socialist decades, when Czechoslovak authorities attempted to introduce broad welfare policies in order to cope with harsh economic realities of the 1970s and 1980s, and tried to secure social and political stability after the upheavals of 1968. In this paper I will discuss how Czechoslovak sociologists contributed to socialist state welfare policies between 1968 and 1989. Both academic officials and scholars highlighted the importance of sociology in providing relevant expertise for dealing with various aspects of welfare policy-making. This paper will examine which research topics and theoretical concepts were central to the program of late socialist sociology of welfare in Czechoslovakia.

Contribution ID: 827

Paying attention to each other's feelings. East German management training and the transnational geneaology of its psychological techniques

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During the late 1960s, East German social psychologists developed a social psychological training program for socialist leaders in the party, administration, and foremost, in industry. The training scheme aimed at raising economic productivity – the political 'main task' in the context of Cold War competition – by fostering empathy and authenticity between leaders and subordinates. This program drew heavily, albeit in a discreet and surreptitious manner, on methodologies from Western humanistic psychology and group dynamics. Was this circulation of knowledge a bottom-up and even subversive process, initiated by high ranking psychologists deeply engaged in Cold War transgressions? Or were psychologists commissioned by the ruling Socialist Unity Party to transfer techniques considered efficient under capitalism? What happened to the accompanying Western ideological values such as individual freedom and personal growth? I will discuss the practice of leadership training not only as a site of convergence between East and West but also as a foucauldian 'technology of the self' flourishing not only in the West but also under state socialism.

Session XVI (Part 2/5) - Medicine

Contribution ID: 1236

Rough on rats: pesticides and suicides in the age of empire

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Emerging from a larger book project called *Losing the Global War on Rats*, this paper traces the history of a single product—the American arsenic-based raticide "Rough on Rats"—as it circulated widely in global markets from the 1880s to 1930s. Because existing histories of arsenic suicides in the nineteenth century by Deborah Blum and James Wharton are national in scope, this paper positions rat-poison suicides transnationally. The paper uses textual analysis of controversies about suicides and pesticides in the popular press and scientific journals to unpack terms like "suicide mania" or the more technical "suicide epidemic." These texts come from locations as disparate as the U.S., Britain, France, Austria, Australia, New Zealand, Egypt, India, and Panama. Furthermore, dialog was truly transnational, with sources from one location often citing debates from other locations. These debates touched topics including hospital administration, alcoholism, regulation of consumer poisons, and worker safety. Analysis of suicide rates by social and medical scientists showed that suicide was gendered (male), and that it was more prevalent in colonies than in imperial metropoles. Above all, this paper asks: What are the human harms of pest control? How did campaigns against rats create human victims? And why are these human harms—like so much of what ecocritic Rob Nixon calls "slow violence"—undocumented, uncounted, unrecognized? The debates over Rough on Rats thus prefigured the more famous debate over the broader health, ecological, and social consequences of pesticides started in the 1960s by Rachel Carson's *Silent Spring*.

Contribution ID: 1083

Ukrainian researchers of the spanish flu pandemic in 1918-1920

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In 1918-1920 there was a civil war in Ukraine. However, medical scientists accumulated observations, analyzed epidemiology features, morbid anatomy, and a new disease clinic. They found that the first cases of Spanish flu appeared in Ukraine during the first wave of the pandemic, i.e. in May and June 1918. However, then it did not manifest itself with a sharp, pronounced rise in the incidence and severe course (I.S. Magat; V.N. Speransky; I.I. Fainshmidt). During the second wave of the Spanish flu pandemic, since August 1918, there was a significant, candle-like increase in the incidence and mortality from the Spanish flu and its severe course (V.K. Stefansky). It was shown that the Spanish flu was complicated by pneumonia mainly in patients aged 16 to 30 years, and it was at this age that it gave the greatest mortality (V.R. Meyer). In October 1918, the number of deaths from pneumonia was 35 times more than in the same month on 'average for the five previous years (M.M. Tizengauzen). L.V. Gromashevsky proposed a method for determining the approximate number of deaths from the Spanish flu. Using the approach of Gromashevsky, in Ukraine over the years of the pandemic, about 300 thousand people died from the Spanish flu. The researchers of the Spanish flu pandemic in Ukraine were not «giants» in medicine. They can be classified as «dwarfs» in the history of medicine. However, without the work of ordinary researchers, our knowledge of the Spanish flu pandemic would be incomplete.

Contribution ID: 1087

Science, history and ethic: the anthropological anti-racist discourse of Juan Comas in Mexico.

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During the first decades of 20th century, the "race" term was an analytical category widely accepted in the Mexican physical anthropology. It allowed to study the human variability, the typological and cultural diversity, their causes and mechanisms. However, since 1940's the work of Juan Comas Camps implied an epistemic transformation displacing the "race" category of the anthropological field, and characterizing it as an obstacle to understand the human been from the physical anthropology view.
Comas was a pedagogue and anthropologist born in Spain, who migrated to Mexico at the end of Spanish Civil War due his participation in the government of the Republic.
His arrival and later nationalization coincided with a political and cultural environment dominated by a nationalist sentiment, inherited of the Mexican Revolution of 1910, which sought to eliminate the differences between Mexicans by promoting the idea of a nation in which the "mestizo" was a sign of unity.
The Comas' experience in Europe, the politics concerns in Mexico, a social reality characterized by ethnic, social, economic and cultural inequality in the country, the paleanthropological developments and the molecular anthropology studies favored the structuration of anti-racist discourse one that guided his research and his work of scientific dissemination.
The aim of this proposal is to analyze the way in which the anti-racist discourse of Juan Comas linked scientific theories, historic approaches and ethics considerations, which could lead us to understand one of the elements that made him a first order personage in Mexican anthropological history.

Contribution ID: 1090

The Relationship between People's Beliefs and Medical Activities in Hubei in Late Imperial China

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During the Ming and Qing Dynasties of China, the development of medical technology was booming, but there were still many mysterious medical activities in society. In Hubei region, most of local people believed in wizards and ghosts deeply. There were inextricable entanglements between people's beliefs and medical activities, which were manifested in the three major aspects of the activities to exorcise the diseases, daily medical treatment and the operation of religious groups. The people of Hubei believed in God Nuo, God of Plague, and God of Emperor Zhenwu, and they held a series of activities to exorcise the diseases. They not only inherited the etiquette about exorcism of the predecessors, but also developed and transformed the content of the activities and the image of the gods. In the specific daily medical treatment, the Buddha and sorcery beliefs of the patient always interfered with the doctor's diagnosis, then affected the treatment effect. Some religious groups often took advantage of medical treatment to promote their doctrines, such as the writing planchette (Fu ji) group and white lotus teaching(Bai lian jiao). These cases show that the religion and medicine were mutually complementary and fettered in Hubei of the Ming-Qing China, it has caused many contradictory social phenomena. Some of them have gradually became an important part of local folklore, while others have became one of the factors of unstable social order. On the one hand, it reflects the essential pursuit of life and health of ordinary people in late imperial China, as well as their urgent mood of seeking comfort when they had illness. On the other hand, it show a clearly picture of common health practices in Hubei to us.

Session XVIII (Part 1/2) - Mathematics

Contribution ID: 1167

Different languages of number: a comparative study of the numerical mysticism of Early Pythagoreanism and Book of Changes(Chou i)

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Jacob Klein has put forward two concepts of number in his various lectures and essays. The first kind of number refers to "a definite number of definite things". The concept of the second kind of number means the more general concept such as twoness. If we go beyond the area of mathematics and look into the history of the number itself, we can see a third kind of number. Both in ancient Greece and China, the number also has mystical meanings, often representing gods, big events or lucky things. Both in the texts of early Pythagoreanism and Chou i, mystical numbers mainly symbolize three kinds of special things. The first one is the combination of male and female. Both in ancient China and Greece, the odd numbers referred to men and even to women. And thus the combination is represented by the the sum of an odd and an even number. The second kind of things numbers stood for is different senses of space. for the Pythagoreans, number 4, which represents four basic geometrical elements, spot, line, plane and volume, came to be the symbol of the objects in the space. Whereas the 8 was important in

chou i, for it is the quantity of all the directions of the universe. The third thing is the sacred being. Each integer from 1 to 10 corresponded to a god for Pythagoreans. And Chinese use 5 and 9 to represent the emperor, who is called as "the son of the heaven".

Contribution ID: 1200

The Recension of the Conics of Apollonius by Naṣīr al-Dīn al-Ṭūsī

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The *Conics* of Apollonius had been translated into Arabic in 9th century in Baghdad. The transmission of this Arabic translation among the mathematicians of the medieval Islamic world contributed to several commentaries and redactions in purpose of facilitating the access to this treatise and the geometry of the conic sections.
In 13th century, Naṣīr al-Dīn al-Ṭūsī - the famous mathematician and philosopher – composed a new recension of the *Conics* of Apollonius. The examination of this treatise which was never studied before, shows at what point the initial Arabic translation of the *Conics* had been improved and which aspects of this translation were refined by al-Ṭūsī. Furthermore, the comparison between the recension of the *Conics* by al-Ṭūsī with his predecessors, like Abu al-Fatḥ al-Iṣfahānī (12th century), shows that not only a large lexical element of this recension was borrowed from *The Summery of the Conics* by al-Iṣfahānī, but also al-Ṭūsī employed some formulations and geometric figures from the treatise of al-Iṣfahānī.
In this paper, the methods of al-Ṭūsī in his recension of the *Conics* will be presented. We will examine the primary sources and the secondary sources, as well as some linguistic aspects of this recension, which sheds some light on the history of the transmission of the *Conics* of Apollonius.

Contribution ID: 1108

New Insights into the Medieval Arabic Transmission of Euclid's Elements

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A recently discovered manuscript (Paris, BULAC Ara 606) contains a version of Euclid's Elements different from any of the already known Arabic primary transmission manuscripts. Although the manuscript itself contains no claims regarding its relation to the early Arabic translations reported by Ibn al-Nadīm, an examination of the internal evidence shows that the manuscript reflects nearly all of the reported differences from the textus receptus that have been ascribed to the translation of al-Ḥajjāj. The manuscript also contains many differences in diction and style from the textus receptus. In this paper, we review the internal evidence and suggest that this manuscript may represent a branch of the transmission deriving from the translation activity of al-Ḥajjāj. Thus, this new manuscript opens a new window into the early medieval transmission of Euclid's Elements. In addition to its historical value, the manuscript also offers a fascinating glimpse into the scribal practices of the medieval period because it is unfinished, a work-in-progress -- the diagrams at the end of the codex have not been drawn and the red rubrication is incomplete – giving a snapshot of the copyist at work.

Contribution ID: 1062

"Arte giamata arismetica et cum altre cose insema": abbacus manuscripts in 15th-century Lombardy

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The landscape of Mediaeval arithmetical treatises with educational purpose (the so-called abacus literature) is wide and, in relevant part, not yet studied. In this work, three unpublished manuscripts are taken into consideration due to their common origin: Lombardy. The first one is linked to the Marliani, a renowned family of the Milanese duchy under the Visconti and the Sforza. Feudal lord, Giovanni Marliani was famous as a scientist and protophysician at the Sforza's court, quoted by Leonardo da Vinci in his Codice Atlantico, and owned many scientific manuscripts: among others, an abacus manuscript, dating back to 1417, whose digital copy is now housed in Genoa, Biblioteca Nazionale (A II 39). The second manuscript, housed in Turin at the Biblioteca Nazionale (N. III. 53), is a copy of the previous one, while curiously and largely reworked both from the language and the content point of view. The last one, whose author is the abacus master Amedeo de Landis, is housed in Germany, at the Pommersfelden Gräflich Schönbornsche Bibliothek (278) and dates to 1427. Written in Milan, it appears largely influenced by the Tractatus Algorismi written in Montpellier, in Southern France, by Jacopo da Firenze in 1307, whose copy is also preserved in Milan at the Biblioteca Trivulziana. The analysis of these manuscripts, undoubtedly representatives of a minor scientific corpus of works, the abacus literature, can contribute to shedding light on the cultural side of the Milanese Renaissance in a significant historical moment, which was going to be populated by prominent figures.

Contribution ID: 1076

Tratado de la fábrica y uso de las pantómetras (Anonymous, 17th c.)

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Tratado de la fábrica y uso de Las Pantómetras is a 17th-century Spanish unpublished anonymous manuscript on the construction and use of sectors. It begins with a reference to the first chapter of Christoph Clavius's *Geometria practica* (1606), where the construction and use of a mathematical instrument called *Instrumentum Partium* is explained.The manuscript author places this instrument at the origin of Flemish sectors, the subject of his treatise

The first part is devoted to the construction of the twelve sector's scales. Far from collecting a set of practical instructions, Euclid's *Elements* –especially Book VI– are repeatedly referred to in order to check, when possible, the solid geometric foundations of the sector scales. As the author puts it, the first central arithmetic scale *converts lines into numbers and, inversely, numbers into lines*. This justifies the numerical consideration of continuous magnitudes as approximate quantities, since a sensorily imperceptible margin of error is irrelevant for application purposes. The same argument is used for the solids, circles and trigonometric scales, when instrumental operability of sectors excels geometric methods or arithmetic calculations in terms of time and errors savings. Thereby, this manuscript shows how mathematical instruments contributed to the substitution of the original Euclidean notion of size by the notion of quantity and to the rise of a new arithmetical rather than geometrical notion of magnitude.

Symposium_Migration, transportation, mobility and displacement (ICOHTEC) - ID 158

Contribution ID: 201
Displaced cities: interiority and identity in refugee camp

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In recent years, refugee numbers have surged globally. In some cases, massive exoduses have formed entire cities: refugee cities. Residents, most of whom are families with children, spend increasingly longer periods of time in camps waiting for resettlement. While the nature and duration of contemporary refugee housing have changed, the technical mindset for the design of temporary housing remains fixed in a post-WWII model. Within the contextual shifts that population displacement ensues, this paper examines the implications of technical shelter solutions on interiority at multiple scales, including that of the refugee shelter, the camp, and the refugee city. Miller and Rasmussen's 2017 study of civilians displaced by armed conflict, published in *Epidemiology and Psychiatric Sciences*, found that the lack of residential stability provokes a sense of perpetual homelessness, affecting the refugees' mental and physical health. Interiority offers an alternate trajectory toward spatial production of home. Interior design carries the code of everyday life and formulates the backdrop for spatial memories, thus playing an integral role in foregrounding identity. Due to their haptic nature, culturally driven occupancy patterns formulate spatial memories capable of withstanding geographic relocation. Those recollections are often the only assertion of identity a refugee carries through the relocation process. Within the context of the refugee city, a hybrid interiority emerges composed of fragments of transferred memories and the pressing impositions of necessity. The domestic experience depends on the provisions of the collective setting. Here, inside and outside designations degrade, and a fertile elasticity between interior and exterior emerges.

Contribution ID: 241
Racist Borders: Technology, Pseudo-Science and Migration Policies in late 19th Century Germany, Russian Empire, Canada, and Brazil

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Technological innovations of the nineteenth century facilitated the mobility of ever larger population groups. As a result, they also led to unprecedented levels of migration, both on the global and the regional levels.
While improving transportation technologies fostered cross-border mobility, other technologies tried to hinder these very population movements. Based on racist pseudo-science and exclusive ideas of statehood, politicians all over the world developed instruments of inclusion and exclusion on ethnic grounds, utilizing sophisticated technologies of border control.

The paper looks at these policies on the examples of Germany, the Russian Empire, Canada and Brazil. I argue that the global development of transportation technologies goes hand in hand with global policies of migration control and racist attitudes. Along the lines of the metaphor of a "yellow peril", anti-Chinese policies develop at the same time in Canada, the USA, and the Russian Empire. The same is true for anti-Semitic policies at the borders of Germany and Russia.
The recent racialization of the outbreak of COVID-19 is only the latest example of how migration policies are oftentimes shaped by irrational fears tied to health concerns – be it the "Asiatic" Cholera or the "Eastern European" Trachoma, both linked to immigrants.

Contribution ID: 382
Mobile Jobs, Mobile Worksites in the Tennessee Valley Authority (TVA), 1931-1945.

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Temporary housing for workers by TVA in their Villages and Camps serves as an early and seminal template of modern 'mobile living' for families whose economic displacement during Great Depression converted them into economic migrants. The temporary village housing and camps TVA staff designed for workers not only 1) serve as a travelling exhibit of modern life, but also 1) provide technical solutions and templates for fast track construction of housing, 2) explore use of new composite materials and construction techniques, 3) are easily dismantled, transported and re-erected to provide housing at the next site as TVA built successive projects, and 5) provide hope and stability in a time of great uncertainty.
While it was not part of TVA's intent the modern mobile lifestyle these villages, along with other government constructed housing showcased provided a template of another sort – a business model for a post-war mobile and modular housing industry that cultivated recreational and economically driven patterns of 'mobile living' and easy migration of entire families between work-sites in the post-war period in the United States. This paper utilizes graphic and text materials on demountable and prefabricated housing development from the TVA archives, as well as archival material on the early development of the post-war mobile homes and housing industry in the USA between 1941-1955.

Symposium (Part 4/4) The materiality of knowledge circulation between China and Europe: physical formats, epistemic genres, spatial localities (16th-18th century) (ISHEASTM) - ID 34

Contribution ID: 194
Little tools of Sinographic knowledge

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'Paper technologies'—historically contingent practices of script and support—have drawn increasing scholarly attention in recent years as an integral material factor in the making of scientific knowledge, notably through case studies of individual scholars, their notekeeping, letter-writing, and indexing practices, and the textual communities they helped constitute. So too have the 'information orders' through which, as recent scholarship has shown, empires and nation-states have exerted control, notably through bureaucratized modes of paperwork from forms and questionnaires to telegrams and atlases. In this presentation I propose following the trajectory of one particular work—a Confucian classic, the *Great learning* [大學 *Daxue*]—through the entangled materialities of early modern European and late imperial Chinese print publication in order to analyze the means by which sinographic lexical material was re-ordered on the page by and for relative novices in handling such scripts. A close look at the "little tools of knowledge" at issue—techniques of textual and paratextual translation, of annotation and bibliography—can help us reconstruct the mundane practices at the level of both paper technologies and information orders through which producers and consumers of printed books in this period negotiated an increasingly globalized textual landscape.

Contribution ID: 568

Michael Boym SJ (1612-1659) and the publication of Flora Sinensis (Vienna, 1656) as part of the Jesuit enterprise

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The Jesuit botanist Michael Boym's *Flora Sinensis* (Vienna, 1656) was arguably the foremost Western work to describe and portray Chinese and Western Indian plants and animals. Historically, scholars have long debated why Boym included non-indigenous fruits in a book about Chinese flora and fauna. If, however, we place Boym into the knowledge circulation networks of his time, it makes sense that he also would have paid attention to transplanted plants that were coveted commodities. The presentation focuses on these less obvious layers of natural history. Beside sharing scientific knowledge about botany and zoology in *Flora Sinensis*, Boym depicted and described natural objects as commercial commodities that could provide valuable information to possible sponsors and investors. His text provides numerous details essential for commercial purposes regarding the location, the harvesting and seasonality of the plants, or the traded parts of the animals, along with their prices at local markets.
This case study shows that while Jesuits were keen on spreading Christianity, they also needed financial support for their overseas missions and used various types of advertisement to this end. Publishing a book which, with its hand-coloured images, was a valuable work of reference on natural history, also helped promote possible investments. This held true even for people living in places such as Vienna (where the book was published), which were not hubs for maritime trade. By unpacking this book, we can see how its configuration and choice of species reveal new understanding about how different interests co-existed.

Contribution ID: 50

Georg Joseph Kamel SJ (1661–1706): Natural knowledge in transit between the Philippines and Europe

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When stationed in Manila at the turn of the eighteenth century, the Jesuit pharmacist Georg Joseph Kamel found himself engaged in encounters between European and local traditions of knowledge. Based on his local experience, he produced comprehensive treatises of Philippine and Chinese flora, which were later printed in Europe. Focusing on the practices involved in Kamel's knowledge production, this paper will explore Kamel's strategies in appropriating Philippine nature from local to European contexts. I will open with an examination of Kamel's plant classification system, which reveals categories of knowledge inspired by Philippine indigenous and Chinese traditions and shows entanglements between European science and local exigencies. However, upon arrival in Europe, these hybrid categories found little understanding among sedentary European naturalists and became lost in translation. Kamel was more successful in his attempts to transplant local medicinal herbs. By building associations with plants described by canonical of the Old World, Kamel sought to 'Galenise' foreign medicinals – that is, to incorporate them into the Galenic medical tradition. In this manner, Kamel endowed plants with clear theoretical foundations comprehensible to European experts and customers and paved the way for their deployment on both local and global scales and markets.

Contribution ID: 727
The Golden Mirror of Flowing Waters and the Global Mapping of Waterways

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The early modern period saw major developments in hydraulic engineering in both Europe and China – and the exchange of knowledge between them. In 1725, the Qing official Fu Zuhong published the *Golden Mirror of Flowing Water*s. This book included visual illustrations of China's major waterways, focusing in particular on the Grand Canal, which connected Hangzhou with Beijing, primarily for the purpose of shipping grain tributes. In the middle of the eighteenth century, the Grand Canal became a subject of great interest to the statesmen and scholars known as the Physiocrats, who studied the industry, economy, and agriculture of Qing China as a model for the reform of France. By 1777, copies of the Chinese book had made it to Europe, as well as a partial translation composed by the Chinese Catholic priest Aloys Ko – who had made his own study of European canals while touring France under the patronage of the Physiocrats. In this talk, I consider both the verbal and the visual maps of the Grand Canal found in various versions of the *Golden Mirror of Flowing Waters* to retrace a cross-cultural conversation the science of canals and the science of the state.

Symposium (Part 4/5) Computing in the sciences and in technology. An Aristotelian perspective (HaPoC) - ID 14

Contribution ID: 48
How Lew Kowarski brought computing to CERN

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The beginnings of computing are deeply intertwined with the history of US military research in nuclear physics, and so it might come as a surprise that, when the European Organization for Nuclear Research (CERN) was founded in 1954, there was neither a budget nor a plan for acquiring a computing machine. CERN bought its first mainframe computer, a Ferranti Mercury, in 1956, although the machine was actually delivered only in late 1958. What motivated this change of plans? Had European particle physicists finally realized what an important asset computing was for their discipline? Or was the CERN management rather convinced by advertising campaigns of computer producers like Ferranti or IBM? Although these factors would later contribute to shape CERN computing, archival material shows how its beginnings can be primarily traced back to the personal initiative of the nuclear physicist Lew Kowarski, at the time CERN's Director of Scientific and Technical Services.
Despite having limited direct experience with computing, Kowarski was convinced that digital methods would open up new research perspectives for particle physics. On the basis of his exchanges with CERN management, physicists working with computers at various institutions and computers producers, I will endeavour to reconstruct the many factors which, set in motion by Kowarski's initiative, contributed to shape early computing at CERN.

Contribution ID: 771

The principle of the division of labor in computing practices (1940s-1950s): presuppositions, advances, biases

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During and after World War II, high speed automatic calculating machines were developed in collaborative contexts (ENIAC, EDSAC, EDVAC), where specialized actors collaborated to exchange their view on the role of electronic computers, and to contrive new methods to use them efficiently.
As these machines led to an increasingly fine decomposition in elementary units, the division of labor became extreme at the operating level, but its social impact would depend on what was at stakes in the various contexts where computers worked.
At the time when they were designed and built by and for their own users, the various actors had first their initial background, and every one played an active role in the process.
When computers started to be produced by industry rather than for laboratories, new qualifications merged, which would be quickly standardized. As users were outside the making process, they became considered as more passive, especially with the development of programming languages. In the post-war competitive context, the hierarchy already underlying the division of labor in manufactures and in computing offices met and strengthened the hierarchy of disciplines.
This talk will examine the effects of the reinforcement of this hierarchical conception of computing procedures and of the lack of coordination so induced for the actors of data processing at the level of their conceptualization as well as that of their use. The dilution of responsibility and the loss of view point on the relations between mechanical computing and its purposes in human affairs will be particularly examined.

Contribution ID: 236
"Coded conduct: making users and the automation of mathematics"

Stephanie Dick
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This paper focuses on the development of an early algebraic computing system called MACSYMA that was developed in the 1960s through 80s at MIT. Would-be users of the system had to learn to think in new ways about mathematics and mathematical problem solving through the lens of the systems' capacities. And developers had, as much as possible, to imagine the needs of users and fashion the system accordingly. Neither users nor developers were ever alone with the machine. To build the system or to use it required continuous acts of accommodation, translation, communication, and calibration, not just between people and technology, but across mathematical problems, machines, programming languages, and other people. The system worked when these acts generated shared codes of conduct that were both technical and social. The many iterations of manuals, tutorials, and other training literature reveal the process through which these shared codes were negotiated, as well as their many overflows, failures, and frictions. In particular, they reveal the modes of thinking and problem-solving that aligned with MACSYMA's changing capabilities, codes that were meant to align users and developers relationships with the machine and each other. This paper explores those shared codes of conduct in order to argue that MACSYMA was not the product of concatenated "top down" acts of invention or design and "bottom up" acts of active approriation on the part of users, as history of technology too often depicts, but rather of designers, users, and machines coordinating and accommodating one another.

Symposium (Part 4/5) Re-scaling & de-centering the history of oceanography: the 'hidden figures' and hidden dimensions of global ocean science (ICHO) - ID 455

Contribution ID: 636
Giants of the deep: Scientific and cultural encounters with polar gigantism in Antarctica

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Early polar explorers and ocean scientists were fascinated with the remarkably large creatures they encountered above and below the sea ice around the Antarctic continent. Charles Laseron, a collector of biological specimens with the Australasian Antarctic Expedition led by (Sir) Douglas Mawson in 1911-14, was one of the first to record the bizarre array of specimens dredged from the depths of the Southern Ocean, including giant red sea spiders as large as dinner plates. During the twentieth century, polar gigantism came to be recognized as an important aspect of evolutionary biology, offering tantalising glimpses into the adaptations of creatures in the depths of these icy waters. This paper explores the scientific and cultural dimensions of polar gigantism in the Antarctic region, focusing on the interaction

between Australian ocean scientists working in the extreme conditions of the Southern Ocean in the early twentieth century, and the giant creatures of the deep that sustained popular myths about sea monsters in Australian literature until well into the twentieth-century. More broadly, this paper examines how the ocean sciences, aided by new technologies, were transforming cultural perceptions of the ocean surrounding Antarctica, from a hostile polar environment of sea ice and simple animal and plant life, to a rich, complex and fragile undersea world. It represents the early stages of an environmental history exploring the entangled histories of human and marine life in the vast, dynamic world of Antarctic sea ice in the Anthropocene.

Contribution ID: 969

Science in a Sub: the inter-war expeditions of Vening Meinesz

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The history of oceanography knows Felix Andries Vening Meinesz (1887-1966) as the Dutch geophysicist whose gravity measurements at sea contributed key evidence for plate tectonics theory as it developed decades later. But his submarine expeditions from the Netherlands to Java in the 1920s and 1930s are interesting in their own right, and prompt many questions. Why did a civil engineer and geologist go to sea? How does a sub become an expeditionary vessel? How did these expeditions become a mascot for the Netherlands? From the perspective of the history of science, Vening Meinesz is an emblem of the efforts in the first decades of the twentieth century to develop new global perspectives and methods, connecting subjects like geography, geology, physics, climatology, vulcanology. His expeditions garnered popular attention that compared him to a character from Jules Verne. His experiences are a window into the re-ordering of the world's travel, economic and imperial networks after World War I. Vening Meinesz's expeditions in the inter-war years, travelling along familiar ocean routes in an unfamiliar style, tell us how new technologies, international ideals and scientific practices changed the way that oceans were studied and imagined in the 1920s and 1930s.

Contribution ID: 610

Canada's underwater habitat program and vertical dimensions of marine sovereignty

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Underwater habitat development during the 1960s and 1970s deserves greater attention than it has yet received as it highlights a peculiar confluence of military, scientific, and popular interest in the colonization of the seafloor characteristic of the period. Existing accounts have focused on American habitats, notably Sealab and Tektite. But this approach overemphasizes a Cold War narrative in which the sole protagonists of the habitat programs are the United States and the Soviet Union. At least 65 habitats were built between 1962 and 1991. Some were state-sponsored, with significant programs run by French, German, Japanese, and Canadian teams. This paper takes as a case study the Canadian Sublimnos habitat as well as the underwater exploration programs it helped launch in Newfoundland (Lora-1) and in the Arctic (Sub-Igloo). The Canadian case demonstrates that technological expertise and

public enthusiasm for underwater exploration should not be solely understood with reference to Cold War interests of the two superpowers. Rather, the international range of habitat programs of the 1960s and 70s reveals an expanding interest in the vertical underwater dimension fueled by numerous national scientific aims and territorial claims.

Symposium (Part 3/3) History of technology and museum business in XXI century. Information technology and computer science: heritage issues - ID 846

Contribution ID: 951

E-POSTER Eastern European computers in the 60s and 70s: independent design, licensing, and cloning

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The author contradicts some of the myths surrounding the role of Soviet (and in general, Eastern European) industrial espionage in the design and production of mainframe and minicomputers in some Eastern and Central European countries during the 1960s and 70s. The author analyses the impact of COCOM and COMECON on computer designers and manufacturers' freedom of choice; and outlines the various aspects involved in cloning the most popular Western architectures and transplanting them onto other hardware bases, its advantages and disadvantages, and its impact on the Eastern and Central European region's own designs. Mention is also made of some of the most popular clones designed and manufactured in countries outside the CEE (West Germany, Japan). The main examples chosen to illustrate these aspects include the Polish Odra 1300 series, the Czechoslovak Tesla, the Romanian Felix, the Hungarian TPA and Videoton, and COMECON joint ESR/RIAD mainframes and SM minicomputers' projects.

Contribution ID: 950

E-POSTER Iskra Delta project "Milijarda" (en.: Billion) – Yugoslavs setting up an internet network in China in 1984

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We'll examine a story of a Yugoslav startup Delta (1974) which was merged with the local electrotechnic industry leader Iskra to form Iskra Delta in 1978 to become an influential computer manufacturer nested in the "no man's land" on neither side of the curtain successfully trading between the West and the East in the then Yugoslavia, now Slovenia.
At the peak of it's business in 1988 Iskra Delta employed more than 2000 people, with an annual revenue of $81M ($176M in today's value). In 1984 Iskra Delta embarked on and successfully delivered what was deemed not only a technically challenging but also politically very sensitive endeavor of setting

up one of the first internet networks in China, connecting 8 police stations in growing metropolis (Beijing, Guangzhou, Harbin, Shanghai, Shenyang, Tianjin, Wuhan, Xi'an) with a grid of direct communication computers.
Current situation in computer history will be examining from three perspectives: 1) of formative yet destructive moment for the largest computer company in Slovenia, which lead to it's sudden disintegration and released a relevant pool of talent which had the manpower to influence future development of the industry in Slovenia, but lacked the political backing; 2) the history of Iskra Delta it either glorified/nullified (depending on the source of representation) and as such serves as a example of challenges with recent (still sensitive) historical subjects often encountered in the history of computing; 3) a standpoint of Chinese technological hunger then and technological supremacy today.

Contribution ID: 952
E-POSTER The origins of computer industry in Slovakia

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During 1950ies in the Slovak Academy of Sciences (SAV) arose the demand for computing. Due to Western embargo on HiTech and the lack of hard currency and sources, for Academy was very hard to get Western, USSR, East Germany or even Czechoslovakia made computers. SAV developed own analogue (1958) and digital computer RPP16 (1966–1973), despite the fact that in centrally planned economy, the "monopoly" for all computer technologies was in Prague. The paper will discuss relevant problems of transforming an idea and functional prototype from the academic environment (Institute of Technical Cybernetics SAV) to the computer industry, which produced hundreds of mini computers (1974–1989) and thus enabled to create many applications in different branches of science, education, industry and even culture as well as new jobs in the undeveloped Northern Slovakia. Despite of the centralization, many institutions (especially when was the first Czechoslovak microprocessor mass produced) developed and manufactured microcomputers, with locally fabricated, imported from COMECON or in the eighties from the West, but in the small quantities. This "chaos" existed even on the international level. For example at the COMECON project "Small electronic computers" headed by the USSR (SMEVM). Almost all countries produced the same integrated circuits (Western types clones) despite the fact, that there was demand for larger products mix. But the manufactured quantity uncovered even local demand. After 1989 the Slovak as well Czech production of computers terminated, but qualified experts educated during this process, continued working for the international IT companies.

Symposium Tradition, innovation, and emerging technologies (ICOHTEC) - ID 240

Contribution ID: 920
Creative Construction: The Integral Importance of Froth, Fraud and Fear in Emerging Technologies

Jonathan Coopersmith

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To promote novel industries based on new emerging technologies, the fruit of Joseph Schumpeter's "creative destruction," an increasingly complex infrastructure evolved over the last century of promoters, regulators (usually at least one step behind the promoters), publicists, analysts, market researchers, experts, journalists, lawyers, marketeers, sales agents, and others who tried to stimulate attention and commitment to an emerging technology.
This ecosystem expanded the creative promises of proposed technologies to attract investors, convince regulators, and generate customers and audiences by providing legitimacy and confidence: yes, it will work; yes, you will make a profit by investing as well as helping launch an important technology.
Also inherent in the creative construction of emerging technologies were fraudulent and frothy firms -- firms that intended to succeed commercially but soon failed. These firms acted as an invisible "scam tax" that raised the cost of doing business for all firms by absorbing financing and resources, not only directly but by requiring entrepreneurs and investors to perform due diligence and comply with regulations developed to minimize failure. Such firms also fueled public and investor excitement about the new technology, attracting interest and investment and encouraging more firms to pursue that technology.
Froth and fraud reflected the overoptimism of entrepreneurs, the enthusiasm of promoters and investors, and the reality of technological and market uncertainty. Froth, fraud, and the fear of missing out on "the next big thing" were a key part of the essential "irrational exuberance" to mobilize resources required for new technologies to emerge.

Contribution ID: 820

Metering power: thieves and innovation in electric Mexico City, 1900-1918.

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Electric meters at the turn of the twentieth century stood as physical proof of Mexico City's electrification process. A dedicated department of inspectors inside the Mexican Light and Power and the increasing theft cases that reached the courts spoke to one accompanying issue: power theft. The issues was confronted by individuals who channeled their ingenuity into developing apparatuses and mechanisms to prevent or lessen unauthorized/fraudulent use of electricity. They joined a cadre of homegrown inventors who worked to provide technical answers to the countless quotidian issues brought forth by modernization and urbanization. Electricians and electrical engineers worked to improve metering systems finding interstices for improvement. Regardless of the invention's success, their examination allows us to use a multidirectional model that treats the developmental process of the meter as a technological artifact as one of "alternation of variation and selection."[1] Such a multidirectional view makes clear that "the 'successful' stages in the development are not the only possible ones," that it is "only by retrospective distortion does a quasi-linear development emerges." This approach makes it possible to ask why individual variations perished while others thrived. The technological innovations that reached the patent's office in the first quarter of the twentieth century *chose* to commit their creative minds to safeguard the electric company's private property, and not the users'.
[1] Bijker, Hughes, and Pinch, Eds., *The Social Construction of Technological Systems,* 28.

Contribution ID: 404

"Like dwarves perched on the shoulders of giants". Tradition and innovation in salt extraction technologies: the case of Tuscany (centuries 15th BC-21st AD)

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As Bernard of Chartres suggested with his famous statement, "We are like dwarves perched on the shoulders of giants" (John of Salisbury, Metalogicon, III, 4), the idea of cultural innovation and technological progress is closely related to that one of traditional knowledge. The pivotal role of salt in antiquity is proven by its usage in different domains, from human and animal consumption, food storage, medicine and cosmetic up to textile production and metallurgy. Moreover, the economic and symbolical value of salt justified its use for payments, taxation, wars. This paper aims to analyze the ancient and modern technologies for salt production in Tuscany (Italy), in the period from the Bronze Age (centuries 16th-14th BC) to the present, in order to show how tradition and innovation are related. The analysis of literary, archaeological and archival sources focused on the Tuscan coast between the provinces of Livorno and Grosseto and the cities of Volterra and Siena, will lead to the investigation of different kinds of technologies for salt extraction and their relations with environmental changes. Thanks to this analysis, it will be argued that ancient technology was of primary importance in know-how transmission as well as to improve new productions.

Symposium Neighborhood relations: Revisiting the history of biochemistry and its neighbors in the first half of the twentieth century - ID 193

Contribution ID: 260

Biochemistry — characterized by its linking capacities

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It is not easy to define biochemistry, says a 1944 report written by the members of the Department of Biochemistry at Cambridge University, "for it is really the connecting link between many fields of specialized knowledge." This is shown, according to the of the report, by the diversity of biochemists' collaborative partners: "Biochemists to-day are actively collaborating with physiologists, physical chemists and organic chemists, as well as with those whose prime interest is in the biological sciences, medicine or agriculture." These deliberations inspire the basic assumption of this symposium, which is that analyzing cross-disciplinary research activities and collaborations with biochemical involvement is a promising approach to specify biochemistry's aims and methods in the interwar period.
In my talk, I will introduce this assumption and argue for its plausibility by discussing three such collaborative research projects carried out in the 1930s: *first*, biochemist Kenneth Thimann's collaboration with botanist Herman Dolk in search of the plant growth hormone at California Institute of Technology in Pasadena; *second*, the collaboration of Rose Scott-Moncrieff, a biochemist trained at F. G. Hopkins' University of Cambridge laboratory, with the eminent organic chemist Robert Robinson (Oxford) and the geneticists of the John Innes Horticultural Institution in Merton, the aim of which was to

elucidate gene action and the biosynthesis of anthocyanin pigments; and *third,* physiologist/biochemist George Wald's collaboration with organic chemist Paul Karrer in Zurich on the role of vitamin A in the visual process.

Contribution ID: 232

"Tymonucleic acid was not as respectable as our DNA": Jean Brachet's research on nucleic acid metabolism (1929-1945)

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In his *Biochemistry before the double helix*, Italian biochemist Alfredo Ruffo recounted many of the research lines that characterized the classic era of biochemistry between the 1930s and the 1950s. Among these, the biochemistry of nucleic acids occupied a hybrid position: while at the periphery of both organic chemistry and biochemistry research in the pre-WWII era, nucleic acids turned into central organic compounds in the emerging molecular biology of the 1950s. Indeed, these macromolecules proved to be key actors in cell reproduction and protein synthesis. This paper focuses on Jean Brachet's biochemical researches between 1929 and 1945 on the role of nucleic acid metabolism in embryonic development. In the late 1920s and early 1930s, when Brachet started his enquiries into the chemistry of cell differentiation, nucleic acids were distinguished into tymonucleic and zymonucleic acids, according to their respective localization in animal or in yeast and plant cells. Applying new cytochemical techniques (e.g., Feulgen reaction) to the study of cell differentiation, Brachet was the first to point to the co-existence of these two different macromolecules within the same cell type, and to suggest that variations in the production of tymonucleic and zymonucleic acids during the cell cycle were strongly correlated. This finding fueled a rapid conceptual and terminological evolution: following contemporary advances in organic chemistry, the prefixes *tymo* and *zymo* were dropped in favor of *deoxyribo* and *ribo* nucleic acids, while protein synthesis within a single cell was conceived in terms of the relationship between the two macromolecules.

Contribution ID: 487

Commentary: Of biochemical communities, identity-forming alliances, and Otto Warburg's poaching in foreign disciplinary territories

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"Biochemistry," as the symposium's abstract underlines, entered the stage around 1900 under a variety of names, enjoying frequent exchanges with its disciplinary neighbors in terms of key questions, tools, and practices. The commentary will explore and underpin these general claims through the example of one of the early giants of the field, Otto H. Warburg (1883-1970). Warburg perfectly exemplified the still-fluid identity of the emergent disciplines within physicochemical biology in a wide sense. He comfortably worked across the (alleged) territories of general physiology, organic chemistry, biochemistry, physical chemistry, and biophysics, from studying metabolic reaction pathways in rat liver to quantum efficiencies of green algae -- and he did all of this while heading the "Kaiser Wilhelm Institute for Cell Physiology," that is, of yet another disciplinary sub-species. The contours of Warburg's

scientific career raise questions about the very meaning of the boundaries of biochemistry and its disciplinary "neighborhood" prior to the Second World War. Taking Warburg's work as a starting point, the commentary will highlight some of the overarching issues that the three papers of the symposium address and prepare the ground for a general discussion.

Symposium (Part 3/3) Professional lineages and the pursuit of astronomy in medieval and early modern India (CHAMA) - ID 177

Contribution ID: 282

Mādhava's Lagnaprakaraṇa and its influence on the Kerala school

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Mādhava of Saṅgamagrāma (14th century CE) was a pioneering Indian astronomer-mathematician, widely regarded as the founder of the Kerala school of astronomy and mathematics. In carrying forward his legacy, scholars of this teacher-disciple lineage have credited numerous important mathematical relations and astronomical techniques to Mādhava in their works. However, Mādhava's own works are yet to be fully studied. In this paper, based on a thorough study of the text, we shall discuss the important contributions of Mādhava's *Lagnaprakaraṇa* — a treatise dedicated to the computation of the ascendant. Further, we will also highlight the influence of this text on later scholars of the Kerala school and their works.

Contribution ID: 337

Mathematics embedded in the nṛttaṃ and saṇgītaṃ traditions of India

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The practitioners of various knowledge traditions in India have enabled learners in honing their intellect through diverse disciplines. A careful study of the traditions of *saṇgītaṃ* and *nṛttaṃ* (music and dance) in India enables us to appreciate the scientific knowledge embedded and passed through arts. The theory and practice of *saṇgītaṃ* are interwoven with mathematics and this knowledge is being carried forward by traditional lineages through millennia and is alive even today.

A nuanced play of syllables (*akṣara*) and beats (*mātrā*) bring about rhythm or meter referred to as *vṛttam* employed often in poetry, music and dance. A variety of combinations and rhythmic patterns are common to Sanskrit prosody and *saṇgītaṃ.* An exhaustive compilation of Sanskrit prosody in *Kedāra Bhaṭṭa's Vṛttaratnākara* (C. 13th Century) and a treatise on music and dance, *Saṇgītaratnākara* of *Śārṅgadeva*, throw light on the use of combinatorics in poetry and arts. In this paper we would like to highlight some aspects of these texts and would like to present the interrelated patterns in meters, the models of their representation and encoding, and how they have

been integrated with performing arts. This would help us in having a better appreciation of the fascinating intersection of scientific heritage and cultural heritage of India through performing arts.

Contribution ID: 380

Investigations on eclipse data preserved in the Kerala tradition

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Lineages that pursue scientific disciplines transmit collective know-how, technical procedures, computational methodologies, incremental innovations, improvisations, best practices, and most importantly invaluable data. The long, continuous and remarkable school of astronomy and mathematics from Kerala besides arriving at path-breaking results such as infinite series for pi and various trigonometric functions, has also handed down a rich repository of observational data which has been meticulously recorded. The grand disciple of Parameśvara, Nīlakaṇṭha Somayājī, in his *Jyotirmīmāṃsā* and *Āryabhaṭīya-bhāṣya* states that Parameśvara has carried out extensive astronomical observations including eclipses for 55 years in order to study and refine astronomical parameters and calculations. In this paper, we would like to present results pertaining to preliminary investigations on the records of eclipses preserved in the Kerala tradition and also contrast them with the instances predicted using modern algorithms and tools. We also present the potential scope these historical records of eclipses possess in reliably estimating the historic variations in the length of a day based on accurate observational data from a pre-telescopic era.

Symposium Other than the Population Council: A Trans-Asian History of Science and the Population Problem in East Asia - ID 45

Contribution ID: 93

Imperial Geography of Population: Population at the Intersection of Empire, Nation, and Race in 1910's Korea

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The existing scholarship on population in Korea and East Asia has examined population research with particular attention to the Cold War politics and related family planning programs. This paper traces a genealogy of population research in the early twentieth century in Korea under Japanese rule (1910-1945). It does so by bringing into focus comparative research on population in the 1910s. On the Korean Peninsula, 人口 (*ingu* in Korean/ *jinkō* in Japanese) as both a bio-political and a geo-spatial term emerged as a neologism around the turn of the twentieth century. And yet it soon became one of the most frequently used terms on the colony. I am interested in excavating how the population problem was understood and how it was interrogated in the first 10-year period of Japanese colonial rule known

as Military Rule (*budan seiji*). To do so, this essay focuses on a population study by the Japanese physician Sato Tsunemaru (1872-1954). As a physician of internal medicine, who served as Director of Keijō (Seoul) Garrison Hospital in the 1910s, Sato carried out a comparative study of the population phenomenon on Germany, Japan, and Korea by utilizing various sources, including the German journal *Die Woche* (Weekly Journal, 1899-1944). By carefully delving into the categories, methods, as well as results of Sato's study, this paper will try to draw an epistemological map of population research by shedding light on its origins and politics at the intersection of empire, nation, and race in early twentieth-century Korea.

Contribution ID: 561

"Fertile Womb Battalion": The Politics of Motherhood in the Japanese Wartime Population Policy

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This presentation explores the Japanese government's increasing attention to the maternal body during the wartime period (1937-45). The historical trajectory of Japan's population discourse reveals the ways in which motherhood (*bosei*) were constructed as an instrument for population management. While it was primarily birth control activists who reconfigured motherhood as a vehicle for social, national, and racial progress in the interwar period, the wartime government renewed the population discourse and its gendered nature by institutionalizing the female body for the sake of national welfare. This presentation places the wartime pronatalist policy under the slogan of "give birth and multiply (*umeyo fuyaseyo*)" within the broader population discourse and proceeds to discuss the gendered nature of the wartime population policy that reoriented the roles of female subjects to producing eugenically superior and healthy citizens. The Ministry of Health and Welfare, which itself was an institutionalized form of the population discourse, implemented a set of policies and procedures targeting mothers and women of childbearing age. The Handbook for Pregnant Women (*ninsanpu techō*) Code of July 1942, the Government's "Fertile Womb Battalion (*kodakara butai*)" commendations, and the Eugenic Marriage (*yūsei kekkon*) campaigns exemplify that motherhood, particularly, women's reproductive roles became the central focus of the total war government. By dissecting the politics of gender deeply embedded in the wartime population policy, the presentation aims to illuminate how Foucauldian biopower was deployed through reordering gender relations in wartime Japan and more importantly, how imperative motherhood was to valorizing both life and gender.

Contribution ID: 525

Belated eugenics? "Feeble-minded" children and the emergence of medical genetics in South Korea

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This paper examines how medical genetics emerged in tandem with the reframing of mentally disabled children as the "acute population problem" in South Korea during the 1960s and 1970s. In particular, it pays attention to the interaction between Japanese and South Korean medical specialists and social

workers in the making of medical genetics as a postwar apparatus to control the quality of population. Although "feeble-minded children" (*Chŏngbaga* in Korean and *Seihakuji* in Japanese) had already been the main target of eugenic interventions, in Japan, interest in the children was renewed when they became included in the general education system after World War II. Social commentators and geneticists focused on hereditary aspects of intellectual disability and sought to prevent birth defects through genetic counseling. The Eugenic Protection Law, which was the postwar successor of the interwar national eugenic law, and interwar counseling practices allowed them to promote it. Meanwhile, in South Korea, the children were spotlighted when the military dictatorship first promoted a social welfare policy for disabled children in the late 1960s. This paper shows that how Korean clinicians, geneticists, and welfare workers exploited their interaction with the Japanese to envision their response to the "*Chŏngbaga*" problem and put eugenic ideas in the Mother and Child Health Act of 1973. Another observation is that the legislation was coincided with the introduction of prenatal genetic screening into the country by pediatricians and gynecologists. The historical episode will shed new light on the family planning-centered historiography of postwar population science in Asia.

Contribution ID: 434

Technoscience and Fertility Governance in Taiwan's Family Planning Programs, 1960s-1970s

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This paper employs science studies approach to revisit the co-construction of family planning programs, relevant social science studies, and users in Taiwan during the 1960s. Following the Taichung Study, the national program started in 1964 and shifted from a cafeteria-style service that included a variety of contraceptives to the one that particularly promoted the IUD (intrauterine), which was away from the American consultants' suggestions.
I address following questions to understand this shift: What was the reasoning behind the program's goal and scheme? What did the medical follow-up studies and KAP surveys disclose about the IUD-centered program's pros and cons and users' responses? Finally, what criticism did contested voices make and how the administrators react? In discussing these questions, I show how family planning programs were embedded in population planning, which was an essential part of the national economic planning. Because of the program's one-method (the IUD-centered) and quantity-oriented nature, the management and evaluation systems were quota-driven and neglected the issues around the program's quality. The findings/evaluations of family planning studies pointed to high removal rates as a serious drawback of the program, and yet, the administrators chose to find potential women acceptors rather than to deal with such problems.

Symposium (Part 2/2) Transnational entanglements in Cold War social science – ID 368

Contribution ID: 780

Decentering Cold War Social Science: Alva Myrdal's Social Scientific Internationalism at UNESCO, 1950-1955

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UNESCO's Department of Social Sciences (DSS), set up in 1946, quickly became one of the key transnational players in the rapidly expanding field of Cold War international social science. This paper highlights Alva Myrdal's role as Director of the DSS during the half decade 1950-1955. More specifically I analyze Myrdal's "social scientific internationalism" and how her thoughts on international social science developed in the context of other contemporary forms of scientific internationalism. In important respects, I argue, Myrdal's social scientific internationalism overlapped with the dominating view according to which U.S. social science constituted the unquestioned center of international social science. But under the influence of the global Cold War reconfigurations of the period, she also introduced a more polycentric approach to international social science, within which the Indian case emerged as an increasingly important alternative node in the decentered international social science envisioned by Myrdal.

Contribution ID: 588

'Knowledge Societies' in the Cold War: When 'knowledge' and social science expertise became highly controversial (1940-1980)

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During the Cold War, the place of knowledge, planning, and social science expertise in modern societies emerged as the focus of a momentous transnational debate. The debate, often carried out under the rubric of the 'knowledge society', was directly linked to a fundamental question: whether 'Western' capitalist or 'Eastern' socialist countries were best prepared to provide their citizens with economic prosperity and well-being. The debate raised questions about the nature of social sciences themselves, about the scope and character of their knowledge, and about their roles in public affairs and society. This paper examines how the Cold War confrontation shaped this debate, with a focus on 'Western' Europe and transnational discussions, showing how prominent positions put forth in that debate continue to shape the social and political imaginations today.

Contribution ID: 855

'Algorithmic thinking' as a Soviet reinvention of Western theories: cognitive psychology in the USSR in the 1960s --1970s.

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In the early 1960s, Soviet psychologist Lev Landa became concerned with the cognitive mechanisms behind problem-solving. Supported by the Council on Cybernetics, a powerful Soviet scientific institution,

Landa sought to describe human problem-solving in terms of logical structures. His ultimate goal was to develop a general algorithmic method of thinking that could be taught by human instructors or, even better, by special teaching computers.
This paper makes four intertwined claims. Firstly, I claim that Landa's work on algorithmic thinking had multiple resemblances to the quantitative orientation in American behavioral sciences in the post-World War II era. Landa's interest in human thinking also places him in the camp of cognitive psychologists. Secondly, parallel to the case of the U.S., pressing matters of political and ideological significance informed the push by Landa and other Soviet scholars to develop mathematical methods of inquiry in the studies of human psychology. Thirdly, I claim that Landa's work on algorithmic thinking has affinities with the conception of bounded human rationality produced in the U.S. by other mathematically inclined fields of social science. Finally, while Soviet scholars appropriated many theories and methods practice by Western social sciences, they adapted Western methodologies in ways that reflected specific Soviet ideological, social, and political conditions.
This paper draws on previously ignored archival documents of the Council on Cybernetics and the Academy of Pedagogical Sciences in Moscow. It reveals the crucial role of indirect transnational exchanges between Soviet and American human sciences in the shaping of Soviet cognitive psychology.

Symposium (Part 1/2) The shaping of differences in the historiography of ancient mathematics - Editing and translating ancient mathematical texts (IASCUD) - ID 543

Contribution ID: 659
Authority and Authenticity. Editing ancient mathematics in Restoration Oxford

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Having witnessed the public esteem generated by learned presses in France and the Low Countries, Oxford's notoriously ambitious vice-chancellor John Fell dreamed that the scholarly endeavours of England's oldest university might achieve similar aims. His resulting programme for the mathematical sciences, promulgated in 1672, was impressive: 'The ancient Mathematicians Greek & latin in one and twenty Volumes; part not yet Extant, the rest collated with MS, perfected from Arabick versions, where the originals are lost, with their Scholia & comments: & all illustrated with Annotations'. Only a small part of this proposal was realized during Fell's lifetime, an edition of two works of Archimedes, the *Arenarius* and *Dimensio circuli*, with Eutocius's commentary on the latter, produced by John Wallis in 1676, while the learned world would have to wait more than thirty years before the planned critical edition of Euclid's *Elements of Geometry* came out, primarily under the editorship of David Gregory. Importantly, its publication coincided with important reforms in the academic instruction and examination of mathematics.
The talk will outline the aims and motivation for Fell's original programme before analysing how its partial realization helped establish new standards of textual presentation and philological accuracy. Gregory's edition, begun by Edward Bernard but uncompleted by him due to lack of scholarly interest at the time, would ultimately remain authoritative until the appearance of Heiberg's and Menge's five volume edition of Euclid's *Opera omnia* in 1883-8.

Contribution ID: 730

J. –L. Lagrange and the translation and diffusion of the greek texts

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At the beginning of the 19th century, there appeared a bunch of important Greek texts in French. François Peyrard (1759-1822) and Nicolas Halma (1755-1828) contributed respectively the French translations of Euclid's *Elements* and Ptolemy's *Almagest* (or *Mathematical Composition*), which appeared in 1804 and in 1813. Very interestingly, these two translators both have worked at the Ecole Polytechnique from its establishment in 1794, where they form their project of translating and disseminating the important works by ancient Greek . More intriguingly, the mathematician J. –L. Lagrange (1736-1813), who taught the *cours d'analyse* at this school from 1795 to 1799, played a key role in this project. This talk will reveal Lagrange's influence on the two translators of Euclid's *Elements* and Ptolemy's *Almagest*, as well as their motivations in making new French editions of these ancient Greek works. Moreover, focusing on Lagrange's teaching which also included a history of arithmetic and history of algebra, this paper will show Lagrange's emphasis on the place value character of the modern decimal system, which he explained was due to "the Arabs." However, an analysis of Lagrange's historical statement will give a hint that Lagrange downplayed the contribution of "the Arabs" to arithmetic and algebra, and by contrast, drew more attention to those of "the ancients" and the *moderns* (the Europeans). In the talk, I will try to explain the contrast between the central place of the decimal place-value system in Lagrange's analysis and the fact that his historiography granted so little importance to its invention.

Contribution ID: 804

Using European Algebra to Interpret Chinese Traditional Mathematics: The Role of Mei Juecheng (1681-1764) in the Development of Evidential Studies

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Mei Juecheng (1681-1764), the grandson of Qing mathematician Mei Wending (1633–1721), was a renowned mathematician during the Kangxi reign. In 1712 he was recruited to the court as a mathematician and in the following year joined an imperial mathematical academy as one of the chief editors of *Lüli yuanyuan* (1713-1722), an imperial compendium on music, mathematics, and astronomy. After having learned European algebra from the Kangxi emperor (1654-1722), Mei Juecheng was able to decipher older Chinese mathematical treatises from the Song (960–1279) and Yuan (1271–1368) dynasties whose methods had been forgotten at the time. This led him to expound a theory of the Chinese origin of Western algebra, which was firstly proposed by the Kangxi emperor in 1703. In this paper I will explain how Mei Juecheng analysed the relationship between European algebra and the *tianyuan* method of Song dynasty, and how Mei Juecheng's way in appropriating European algebra created a new paradigm and helped to revive Chinese scholars' interest in traditional Chinese

mathematics. Finally Mei Juecheng's important role in the field of evidential studies in the early nineteenth century will be analysed in the social context.

Contribution ID: 1324

Mathematics and Evidential Scholarship in Eighteenth Century China

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Modern historians usually view Chinese scholars in Qianlong and Jiaqing reigns (1736-1820) as the pioneers for the study in the history of Chinese mathematics. This holds true as far as we consider the fact that most ancient Chinese texts were recovered in the *Complete Works in the Four Treasuries* by Dai Zhen and his colleagues. Recent case studies on Ruan Yuan and other scholars at that time reveal the diversity of these scholars' research approaches and mathematical practices. In this context, this article intends to further study how scholars viewed and treated Chinese mathematical texts from the 13th century from two new perspectives. First, in order to analyze how eighteenth century scholars extracted mathematical writings from the *Great Compendium of the Yongle Reign* and reorganized them. Second, in order to inquire into the relationship between mathematics and evidential scholarship, I will analyze Kong Guangsen's reading notes on the *Siku quanshu* edition of Li Ye's *Sea Mirror of Circle Measurements*. Moreover, I will discuss how eighteenth century scholars who studied *Mathematical Book in Nine Chapters* and *Sea Mirror of Circle Measurements* compared these two treatises with the European algebraic technique *Jiegenfang*, which was introduced into China by the Jesuit missionaries in the late seventeenth century. In a word, this article will contribute to a new understanding of 18th century Chinese scholars' textual practices on past mathematical writings and provide a new context for further studies in both the historiography and the history of mathematics.

Contribution ID: 1195

Session XVIII (Part 2/2) - Mathematics

The axiomatization of arithmetic: from Grassmann to Peano

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The process of axiomatization of arithmetic only took form in the late 19th century, amid the process which is often referred to as the arithmetization of analysis, while it can be said that the axiomatic foundations of Geometry was discussed since the times of Ancient Greece. Bearing in mind the particular conceptions of 'axiom' which were common at the time, the present paper approaches the essential arithmetical work of 1861 by Grassmann, containing the first though unannounced axiomatization as well as the publication of the famous Peano's axioms in 1889, which was influenced by the former. Moreover, such transition has revealed evolving and particular conceptions of certain types of numbers, particularly Peano's approach to the introduction of fractions and negative numbers.

Contribution ID: 1112

'As a experienced missionary would explain the gospel to cannibals': Terracini and Levi in Argentina (1938-1948)

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The racial laws of 1938 ratified the anti-Semitic turn of Fascism and caused the loss of civil and political rights enjoyed by Italian Jews since the Risorgimento. Italian mathematics suddenly lost figures of excellent value such as Vito Volterra, Tullio Levi-Civita, Guido Castelnuovo, and many others.
Following the dismissals, a Jewish intellectual diaspora from racist Italy began. The exile experiences of Alessandro Terracini and Beppo Levi in South America are two examples of a happy ending in the context of this dramatic collective phenomenon.
For Terracini and Levi, the forced migration to Argentina, begun as exiles mourning the loss of their roots and national identity, turned into a true professional breakthrough, because it opened the stage of their life as organisers and sowers of ideas 'in a land that was virgin, but eager to produce'.
In this regard, some courses and seminars held by Terracini and Levi in Tucumán and Rosario particularly stand out.
In our talk, through the exam of these lectures, we entail to assess the impact that racial persecutions had on the Argentine cultural fabric and the dynamics of promotion abroad of some exquisitely Italian traditions of thought, such as algebraic geometry and mathematical logic. The network of interactions that arose between national mathematical 'schools', forced into the diaspora for political or racial reasons, will turn out to be a factor far from negligible in the construction of new architectures of collaboration and in the configuration of new scientific communities in some periphery of South America.

Contribution ID: 1059

Numbers matter – Identity formation, scientific boundaries and community building in applied mechanics and applied mathematics in Denmark

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In 1969 the disjunct adheres of applied mechanics and mathematics at the Technical University of Denmark decided that size and affiliation mattered. Working in small individual research groups, they were no-bodies in the growing international setting of technical academia. They organized in a society called the Danish Center of Applied Mathematics and Mechanics (DCAMM) to get a brand.
Attempting to gain insight into the culture of technical academia, I will discuss what has been at play in DCAMM, which made it an important player on both the national and international scene. Issues of identity formation, community building and boundary work appear to be key.
The members build a strong community to support the academic life from early career. They organized a society containing all the elements of a scientific community and culture and the community only accepted members, who did research in the field of applied mathematics and applied mechanics. This research could take place in a company.
If you want a community with a clear identity, you also had to set boundaries. Who is not included? The members of the society came from different engineering disciplines and basic sciences and there was an ongoing struggle to define the borders and establish trading zones.

DCAMM became the place for members to put their scientist identity. They often mitigated a space including industry and university and had to place dividers to isolate realms.

Contribution ID: 1084

On the meaning of mathematical patrimony: the case-study of Gino Fano's personal collection

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In the last ten years, the conception of mathematical heritage has garnered increasing attention, thanks to the evolution of the meaning of the word 'patrimony' in the field of history of science. Moreover, the development of the 'material culture of science' contributed to shift the focus on scientists' library heritage too. With regards to the history of mathematics, this perspective allows to stress the dynamics of circulation of scientific knowledge and the phenomena of 'mathematical sociability'. With this in mind, an intriguing case-study is provided by Gino Fano's personal collection which is now kept in the Special Mathematical Library [SML] 'G. Peano' of Turin University. One of the giants of the Italian School of algebraic geometry, Fano had donated his miscellany of excerpts (nearly six thousand offprints from journals and periodicals, booklets, lithographs,…) to the SML and, upon his death, his family left all the mathematics books of his private library (187 volumes) to the Institute of Geometry of Turin University. The analysis of this library heritage promotes the highlight of some lesser-known aspects of Fano's biographical and professional trajectory. In addition, the use of digital humanities software, such as Palladio, helps to examine some aspects connected to Fano's international relationships and the cultural roots of his research activity. Finally, this case-study allows to focus on the collective and social dimension of heritage conservation processes and to underline their active role in the production of new mathematical knowledge.

Symposium Medical technologies (ICOHTEC) - ID 239

Contribution ID: 515

Technology and Space——An Evolutionary History of the Operation Room: How did Medical Ideas and Technologies Shape and Reshape Surgical Space?

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Reading the history of surgery, we will find that the space for surgical operations have been changing in their spacial location, structure, organization, and appearance. Although the operating room for surgical treatments tends to be crowded and complex, it is more conducive to the success of surgery and patient safety. All these changes are due to the change of human medical ideas and, as its consequence, the progress of medical science and technology. With the advancement of medical ideas and technologies, the location of surgical space changed continuously, its structure, organization and visual presentation have been shaped and reshaped. Based on the evolution of medical ideas and technologies as the main

thread, with the help of a large number of historical images of the surgical operating room, using images as historical evidence, this paper demonstrates the shaping and reshaping of surgical treating space by medical ideas and technologies, and then reveals how the advancement of medical ideas and technologies affected surgical medicine and its therapeutic effect. Concerned technological advances in medicine resulted from the spacial changes of the operating room will also be discussed here.

Contribution ID: 694

Urban life, medicine market and medical school: regional medical society of Hangzhou from the 16th to 18th centuries

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In the study of medical history, the production and inheritance of traditional Chinese medical knowledge were often separated from the market and society. Focusing on Wushan District of Hangzhou, this paper discusses the relationship between medical school, medicine market and urban life, and explores the professional field and living reality of Hangzhou Medical Society in Ming and Qing Dynasties. At the top of the hill, there was Yaowang temple, which was a place for medicine trade dealers to pay respect and commemorate in honor of the ancestors of Confucian physician. The residents and the patients also came here to pray for health. On the side of Wushan hill, there were also famous doctors gathering in the hall. At the foot of the mountain and on the street, many famous pharmacies were set up here. The positions around Wushan hill in the same space showed that there were very close market and social connections among Confucian physician, disease and medicine. Medical society was not only a professional sector with doctors and medicine dealers, but also an integral part of the social system of the city with long history. It not only served the regional society of Hangzhou, but also fit into the market, society, culture and living space of Hangzhou. They were connected through different paths such as medical practice, communication, trade, belief, publishing and entertainment. In this way, the medical practitioners had a more stable social foundation and market support for teaching and knowledge transmission.

Symposium (Part 3/3) Meteorological and magnetic observatories in the 19th century - ID 279

Contribution ID: 592

The creation of the Austrian I.R. Central Institute of Meteorology and Earthmagnetism (ZAMG) in 1851

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ZAMG is the national, public meteorological and geophysical service of Austria, it will celebrate its 170th anniversary in 2021.

In 1851 the I.R. Central Institute of Meteorology and Earthmagnetism (ZAMG) was founded in Austria/Vienna and the astronomer Karl Kreil (1798-1862) was appointed as its first director. Kreil initially became known through his extraordinary work in magnetism and caught the attention of Gauss and Humboldt. He recognized that in order to carry out meteorological and climatic research, there was a need for a unified network of measurements across the entire Austrian Empire and the establishment of a central station (in Vienna).
In 1877, Julius Hann (1839-1921) was appointed director of the ZAMG. Under Hann's directorship the erection of the ZAMG Sonnblick observatory in the Austrian Central Alps at an altitude of 3106m a.s.l. in 1886 was a technical masterpiece; moreover, the observatory is outstanding with respect to its long-term climate observations.
In 1904, the Seismological Service, which is still working without interruption until today, was founded at ZAMG. The physicist Victor Conrad (1876-1962) became the first head.
In order to meet the modern scientific requirements, a geophysical observatory was established for ZAMG in two construction phases (opening 2002, 2014). Here, seismic, gravimetric and magnetic measurements are carried out at a high level in an undisturbed location, thus continuing ZAMG's long measuring tradition. Furthermore, the observatory, named after Victor Conrad, serves the geophysical research and is a meeting place for the members of the scientific community from all over the world.

Contribution ID: 743

Fail at home, success abroad. The case of the Spanish geomagnetic observatories in the XIX century

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Spain was not present in the early attempts to organize worldwide geomagnetic observations. On the mid XIX century Lamont was in Spain working in the geomagnetic chart of Europe and he did not find any observatory with regular observations.
The San Fernando Observatory, near Cadiz and managed by the Spanish navy acquired English magnetometers as early as 1841. An Adie variometer arrived already in 1875; but we haven't information about regular continuous observations up to 1891. Other attempts were organized at the Madrid Astronomical Observatory and the Jesuit College at Balaguer. But they run just for few years.
Instead, the Spanish colonies of Cuba and Philippines started regular observations in 1862 and 1889 respectively. In both places the observatories were maned by Jesuits. At Philippines a very detailed geomagnetic map was published in 1893. These colonial observatories were important worldwide due to their position near the geomagnetic equator.
In this research I review the naissance of the geomagnetic observatories in Spain and I study the possible factors influencing the fail of the XIX Century geomagnetic studies in continental Spain and the success of similar initiatives in the colonies.

Contribution ID: 779

History of space weather studies and observations: Russian aspect

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The Russian network of magnetic and meteorological observatories was founded in the 30s of the 19th century by the efforts of Adolf Kupfer with a great support of Alexander von Humboldt and Carl Friedrich Gauss. As a result, in 1829 regular measurements in St.Petersburg and Kazan were initiated. Then steadily the network of observatories significantly expanded. In 1837 the first volume of "Meteorological and magnetic observations in the Russian Empire" with information on operating observatories was published. In the 1880–1890s the existing network of observatories was upgraded and re-equipped with modern geophysical instrumentation. By the end of the 19th century more than 140 meteorological and magnetic observatories were in operation within the European and Asian parts of Russia and covered a wide geographical area. The head institution, which aggregated data from all Russian observatories was in St.Petersburg (then it moved to Pavlovsk and later to Voeikovo). Currently, the Russian observational network provides one of the longest geomagnetic data series in the world. The never-ending history of research on electromagnetic ultra-low-frequency (ULF) waves with periods from tens of minutes to fractions of seconds is an excellent example, though on a small scale, of the science evolution, and unpredictability of its ideas and practical applications. The first measurements of electromagnetic field variations with sensitive magnetometers started in the southern parts of Russia and later the Soviet Union for detecting electromagnetic precursors of earthquakes. Further scientific studies discovered a realm of ULF phenomena in the near-Earth environment.

Contribution ID: 818
Algiers 1841: French colony to serve the Magnetic crusade?

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François Arago (1786-1853) didn’t engaged Paris Observatory in the Magnetic Crusade. Nevertheless, he used it as a lever to create a new observatory in Algiers. This maghrebian city was occupied by the French since 1830. In the following years, the French, mainly military, were there under the pressure of a local resistance. In Paris, the King was as well dealing with fears from European countries.
From 1841 to 1844, Georges Aimé (1810-1847), a civilian teacher in physics at the new *Collège d’Alger*, sent magnetic observations to the Royal Society. Instruments, data, publications were exchanged between Paris, London and Algiers. We will argue that the circulation of the knowledge obtained for the Magnetic Crusade got some unexpected results on the French colonial process as well.

Symposium (Part 5/5) Computing in the sciences and in technology. An Aristotelian perspective (HaPoC) - ID 15

Contribution ID: 75

What's in a name? Origins, transpositions and transformations of the triptych Algorithm – Code – Program

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Today, basic notions such as "code", "program" and "algorithm" have been popularized and are used as a means to refer to what lies "underneath" major computing technologies like the Google search engine or the Facebook social network. Indeed, it is "coding" and "programming" which are those important skills that we need to teach our children and it are "algorithms" that rule our world. But those terms themselves bear a semantical history and are not constant in meaning. It is quite well-known within historiography that not realizing this historical evolution of words results in anachronisms which, in our case, not only affect the historian's way of looking back into history, but also those who use any of these terms detached from any history. It is the aim of this talk to consider the historical variations and internal relations of the triptych Code, Program and Algorithm as a contribution to rendering these notions more transparent historically. In doing so, we will show how different formalities, makers, goals and materialities have contributed to a complex history, sketching a changing dynamics between the three terms depending on local contexts. We consider three different stages: the first concerns the "prehistory" of the terms and refers to the history *before* the first larger computing machines. The second concerns the period *around* the first electronic computing machines. Finally, in a third movement we consider the later development of these notions and their interrelations within different different communities up to now.

Contribution ID: 257

A multiperspective causal analysis of computing in predictive models based on machine learning

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Predictive models based on machine learning are more and more in use for different applications having social impacts: pattern (face) recognition, medical (cancer) diagnosis, predictive (crime) justice. For each, due to some kind of black-box effect, we are willing to ask the question: what caused the prediction? In this conference, I will show that it is fruitful - if not necessary - to adopt a multiperspective causal analysis for such predictive models. It is based on the assumption that for the same prediction device, different types of causes concurrently and convincingly can be advocated to have been at stake, but also that some specific *causal profile* - where some causes (material, formal, efficient, final) are found to be more present than others - can be attached to it. Of course, the whole causal enquiry cannot limit itself to the sole machine with its program but has to consider the whole system of human-human, human-idea, human-machine and machine-machine relationships. In this conference, I will not tackle the whole problem. I will focus this multiperspective causal analysis on some human-idea relationships. To show the fruitfulness of this approach, even at this restrictive level, it suffices to evoke the mathematical and metaphysical aspects of the debates around explainable artificial intelligence. As an example, I particularly will apply this causal profile analysis to the following

competing mathematical approach in machine learning: 1) Bayesian, 2) Realist/Biomimetic (between brain and neural networks; see LeCun), 3) Causal statistics (Pearl, Schölkopf).

Contribution ID: 901

Finding a story for the history of computing

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Haigh will discuss the new overview history of computing he has written with Paul Ceruzzi, based on Ceruzzi's classic *A History of Modern Computing*. The talk will focus on the challenges involved in producing a coherent and comprehensive synthetic history of computing and the choices and trade-offs the made during the process.
The biggest challenge is the remarkable flexibility of the electronic digital computer, which from 1945 to 2020 has evolved from a specialized and hugely expensive technology used for scientific computation to an inexpensive and ubiquitous technology embedded into devices of all kinds and used in almost every human activity. Existing overview histories have not fully engaged with now-central topics such as the Internet, smartphones and mobile apps, cloud computing, video games, digital media, or automotive computing. The era saw repeated shifts in users, producers, applications and affordances which make it hard to construct a coherent narrative. The new structure addresses this by basing each chapter around a specific group of users and applications, around which "the computer" is remade with the addition of new capabilities such as interactivity or graphical communication.
Other challenges explored during the talk include the balancing of technical detail against narrative, presentation of the computer's continuities and discontinuities with other technologies, incorporation of perspectives from social and cultural history into a technology-centered story, and engagement with an increasingly broad and diverse secondary literature. Haigh explains the decisions made by the book's and their relationship to its multiple intended audiences.

Contribution ID: 277

Roundtable: Promoting dialogue in the history of computing – an Aristotelean perspective

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As a research area, the history and epistemology of computing is both narrow and broad: narrow as a young field searching for its place within the humanities, broad because of the many different fields that are relevant to it. A growing number of research groups in the field have developed their own methods and approaches, but have so far only occasionally interacted with each other. The symposium explores the potential of a dialogue between the different research lines to stimulate a set of new research questions and discussions. More specifically, the symposium is structured around the four Aristotelean causes as an exploratory tool cutting across established disciplinary borders and bringing to light possible connections.

The final round table will provide a first chance to assess how that plan worked out and will have a bottom-up format, inviting both symposium participants and audience to express their positive and negative reactions. One leading question is what the field might gain by bringing together topics *and* methods which, at the outset, might appear quite unrelated. What are the potentials and pitfalls of a combination of more technical histories with more social histories? Should we embrace this plurality of approaches as a set of different perspectives that cannot be connected, or can we define methods that reinforce one another? Or, to put it more clearly: what can a technical history of programming languages learn from a more business-oriented history of personal computing? How can an Aristotelean approach offered here help to make this happen?

Symposium (Part 5/5) Re-scaling & de-centering the history of oceanography: the 'hidden figures' and hidden dimensions of global ocean science (ICHO) - ID 836

Contribution ID: 980

Secrecy and Sea-floor spreading: Rethinking the role of Navy oceanography in the development of plate tectonics

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One of the great advances of 20th century earth science was the development of plate tectonics, and a key element of the theory was the concept of sea-floor spreading, developed by Princeton geologist Harry Hess. Hess had begun developing a theory of crustal mobility in the 1930s in the context of the debate over continental drift—a precursor theory that was widely discussed in the 1920s and early 1930s—and his own work on marine gravity surveys. But then he set the work aside for twenty years, only to return to it when British geophysicists began to revive the conversation around moving continents. At first, the version of sea-floor spreading was essentially identical to a model he had put forth in 1938. Why had Hess set the topic aside? And why had he made no progress in its development for 20 years? During this time, Hess had tried and failed to get key marine data declassified, and insisting that military secrecy was impeding the advance of basic research. The evidence suggests that Hess was right—secrecy was impeding the advance of science, and he knew it, because his own science was among the work that was being affected. While previous scholars have argued that military support made plate tectonics possible, the story presented here suggest that Navy secrecy in fact impeded the emergence of modern global tectonic theory.

Contribution ID: 977

An 'open secret': Geologists and oil industry secrecy in the Mediterranean's seafloor exploration

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In the 1960s, the growing strategic importance of ocean exploration led the French government to develop greater capacity in marine scientific research. The domestic oil industry received the State's support for exploring the oil potential of the Mediterranean's seafloor, yet the data and knowledge produced remained secret due to confidentiality clauses specified in the exploration contracts. However, this knowledge leaked from the industry's and state-sponsored secret projects, reaching the scientific community of French geologists. Frequently unmentioned in scientific reports, this paper explores the role played by young geologists in transferring scientific knowledge from confidential industrial projects to the French geologists' community; and how they contributed to both: the offshore hydrocarbon's exploration, and to re-write the geological history of the Mediterranean basin.

Contribution ID: 983

Secrecy and seabed mining: questioning the freedom of marine science during the 1970s

Sam Robinson
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The 1960s marked a high point for utopian visions of humankind's future on the global oceans. Imaginaries emerged of underwater habitats, seabed mining, and the recovery of untold riches from the watery world. These futures were built on the rapid expansion of capabilities in, and research on, the high seas driven by rapid post-war growth in oceanography and marine technologies. However, by the early 1970s marine science itself came under heavy attack. The repeated assertions about the "necessity of facilitating disinterested scientific investigations of the world oceans were consistently denied," by the newly independent nations of the Global South. In this conflict over resources and technology, science was seen as a weapon rather than an independent value. The North-South confrontation became the super-issue of the period, and marine science found itself caught up in the wider political clash. This paper will chart the lines of diplomatic conflict over marine science at the UNCLOS III conferences during the 1970s. These debates involved marine scientists, diplomats, and lawyers at the very highest levels of government. In the frustrations of leading scientists – such as oceanographer Roger Revelle and politicians such as Secretary of State Henry Kissinger – more than just marine science came under attack. The entire concept of the hegemony of the Global North in science and technology was questioned and arguably found wanting.

Contribution ID: 1295

The Invisible Sinking Surface: Hydrogeology, Fieldwork and Photography in California

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In 1977, surrounded by vineyards in California's Central Valley, United States Geological Survey (USGS) hydrogeologist Joseph Poland staged a groundbreaking scientific photograph. Posed next to a power-pole marked to show the land surface elevation in previous decades, he provided a human-scale visualization of vast groundwater resources disappearing underfoot. Rina C. Faletti situates this iconic visualization of land subsidence and groundwater loss within a broader history, of California scientific

documentation and agricultural documentary photography, between the 1920s and the 1980s. Her analysis of the visual evidence reveals a parallel subtext of societal conflicts caused by industrial water systems. California's water, agri- and petro- cultures rose as the land surface, and the social substrata that labored to work it, invisibly declined. Faletti's juxtaposition of hydrogeologist's field research photos with photographs of fieldworkers, from Dust Bowl laborers to interned Japanese farmers, Braceros, Black migrant laborers, and United Farm Workers, highlights agricultural documentary photographers' exposure of invisible faces: the laboring classes who bolstered massive-scale water extraction schemes. Issues raised by both hydrogeologists and documentarists have fed water policy interest into the present. In 2014, California's Sustainable Groundwater Management Act set forth a plan for statewide groundwater stewardship into the coming century, and global water security work is ongoing in UNESCO's Land Subsidence International Initiative, founded by Joseph Poland to study land subsidence around the globe. Water images and policies reach deep into water futures, revealing long-term effects of documentary photographers' visual calls for action to remedy invisible problems of water moving unseen in an ever-sinking landscape.

Symposium (Part 1/2) Pedagogy beyond giants and dwarfs: using the history of science to enhance education and promote inclusiveness - ID 508

Contribution ID: 793

The History of Chemistry in Chemical Education

John Powers
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The role of history in science education has recently generated additional interest due to the heightened importance placed on understanding the "nature of science" found in the Next Generation Science Standards (2012). This essay strives to place this development in historical context by examining the changing role of the history of chemistry in chemical education over the last century. I focus on two specific episodes. The first is Edgar Fahs Smith's history of chemistry course which he presented to his students at the University of Pennsylvania, and which aimed to craft a professional identity for American chemists. The second episode is James Bryant Conant's ultimately unsuccessful program at Harvard for general science education, which used historical case studies to teach the practices and methods of science to non-science students. I then discuss how the current emphasis on teaching the "nature of science" to students distorts the history of chemistry in chemistry courses, as shown in a recent proposal for its inclusion in chemistry instruction. What I conclude is that these examples suggest that successful collaboration between historians and science educators is possible, but only is only effective when the professional interests of both historians and science educators are preserved.

Contribution ID: 781

In praise of a historical storytelling approach in science education

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In the 1970s and 1980s, the use of history of science in science education was a controversial topic. In the three last decades attitudes have changed, but the best practice question has not been definitively answered: what type of historical knowledge should be incorporated in pedagogical contexts, and how? In this communication, I discuss features of historically-informed narratives that are suitable for teaching science from upper secondary education on, by explaining cases that I have been developing in my field of expertise, the history of biology. I argue that such narratives should focus on the evolution of fundamental concepts and theories in a given scientific discipline, not the life and work of one or few scientists; that a story's historical content must be carefully selected and heavily contextualized in order to serve pedagogical needs; and that storytelling techniques should be actively used to motivate students. A central part of such historical storytelling approach is not to reduce science to the research of scientific "giants," but rather to contextualize their proposals by showing how their work relied on the contributions of people who have been relegated to the category of "dwarfs," or even forgotten.

Contribution ID: 751

Big history in 10-minute videos: How highlights help in survey courses

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An introductory survey course is often a highlights reel of the biggest names or events in the history of science. When you only have 10 minutes (or a 1,500 word script), how do you choose what to mention? This is not necessarily a place for complexity or nuance, but it does serve a purpose. In 2017 Allison Marsh joined the team to create the Crash Course History of Science educational video series for YouTube. She then began incorporating these videos into the online version of a popular introductory survey course at the University of South Carolina, HIST 108: Science and Technology in World History. During the summer and fall terms of 2019, she collected data hoping to compare content retention among students watching Crash Course videos with those reading a traditional textbook. Graduate student Bethany Johnson, a teaching assistant for HIST 108, saw how the students engaged much more dramatically with the videos than the readings. This case study showed students interacting with the videos in surprising ways and caused Marsh and Johnson to rethink course organization and the pedagogical purposes of a general education history course.

Contribution ID: 763

Bringing history into the lab: a new approach to scientific learning in general education

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The postwar era produced novel pedagogical projects aimed at integrating history and science teaching. Above all, these were shaped by the pedagogy of James Bryant Conant, who placed history at the heart

of general science education. While Conant's expansive vision for history of science ultimately was not realized, its emphasis on experiential learning for non-scientists is worth revisiting for current integrative approaches to higher education. A team of two historians and one biologist has done this by developing a teaching model that infuses the humanities into two general science education courses through history lectures integrated with science labs. We assessed the model's impact on learning outcomes, experiences, and attitudes toward science and history through a blind study of student participants. Our results showed that courses taught using the model significantly improved experiences and attitudes toward science among students who were initially less friendly toward science, and improved experiences and attitudes toward history among students who were initially less friendly toward history.

Symposium Artifices in human form: bodies as technology and technologies of the body in early modern and modern China (ICOHTEC) - ID 343

Contribution ID: 651

Penicillin and the industrialization of pharmaceutical technologies in China

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This paper uses the case of penicillin to investigate the industrialization of pharmacy in twentieth-century China. News of the Allied therapeutic development of penicillin during the Second World War traveled quickly; in China, wartime projects to establish domestic drug production resulted in several local and transnational collaborations. Between war's end and the 1949 establishment of the People's Republic of China, an international committee controlling the United Nations Relief and Rehabilitation Administration's aid to China launched a penicillin production project that built upon these precedents. It brought together established American interests, like Cutter Laboratories, with Chinese scientific researchers and clinicians in the city of Shanghai. In investigating this project, I use records preserved in the Shanghai Municipal Archives to examine the ways in which protecting Chinese bodies required building large technological systems that could ensure steady production of drugs for the nation. Chinese and American collaborators considered large-scale penicillin production the first step in an effort to launch industrial pharmaceutical manufacturing, an endeavor that would require the development of extensive material and human resources, as well as the creative accommodation of existing electrical and hygienic infrastructures. The politically fraught and bureaucratically convoluted effort to establish these processes represented an early investment in Chinese chemical engineering, even as medical professionals rushed to prepare clinical guidelines and discussions of the new drug's therapeutic use. Penicillin was thus both the product of intensive technological infrastructure building and a technology of the body.

Contribution ID: 653

Industrial craft: machine, skill, and the making of the factory system

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Characterized by endless rows of machines tended by "unskilled" workers, the factory system has been recognized as an emblem of an industrial era in which human skills are replaced by machines and handicraft by manufacture. Designed for the production of standardized items in large quantities, these machines were an essential element of the factory system, yet the fabrication process of the machines themselves was far from standardized. Drawing upon engineering journals, machine manuals, and contracts between American machine firms and Chinese cotton mills in the early twentieth century, this paper examines how American spinning machines were modified to accommodate Chinese local conditions, especially short-staple native cotton varieties. In order to produce standard cotton yarn from unstandardized cotton fibers, it was inevitable for the engineers to devise flexible ways to keep the irregularities under control, and customized machines were a natural outcome of such efforts. Although they relied on tables of data to decide on diameters, spacing, and speed of drawing rollers that suited the condition of raw cotton to be processed, on many occasions these data did not provide a definitive answer; as aggregates of average values, they served as a useful guide at best. The rest of the work could be done only by skilled workers with rich experience in the machines and local cotton varieties. By approaching these technical experts' handwork as industrial craft, this paper argues for the significance of manual labor in the making of the factory system, thereby complicating the dichotomy between craft and mechanization.

Contribution ID: 654

Medical things and the healer's body in the Qing court's Golden Mirror, 1742

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In the last month of 1739, the Qianlong Emperor (r. 1736-1795) ordered the compilation of a treatise on medicine "to rectify medical knowledge" throughout the empire. By the end of 1742, eighty participants chosen from several offices within the palace bureaucracy in Beijing completed the *Golden Mirror of the Orthodox Lineage of Medicine* (*Yizong jinjian* 醫宗金鑑). In addition to integrating literati trends in evidential scholarship from the Jiangnan region into the imperial medicine of the Manchu court, the *Golden Mirror* also coalesced publishing trends that made medicine more accessible to a wider audience through rhymes, annotations, and illustrations. The *Golden Mirror* also directed attention to the healer's body as technology – bodily knowledge and knowledge embodied – through instructions on how to use material things and as well as the healer's body therapeutically and cognitively. Readers could learn how to use not only a range of medical tools - acupuncture needles, moxibustion sticks, devices for smallpox inoculation, braces for securing broken bones – but also their own bodies for medical ends from pulse reading to hand mnemonics. In addition to mastering one's senses to read the patient's body and material tools for providing medical therapy, the *Golden Mirror* taught the ideal physician how to situate their patients within Heaven & Earth's transformations via simple calculations they could do on their hands.

Contribution ID: 729

Psychology as bodily technology in industrial China

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In 1935, an enterprising Chinese psychologist by the name of Chen Li 陳立 (1902-2004) published a book titled *A General Survey of Industrial Psychology* (工業心理學概觀). In explaining the importance of the topic to the workings of industry, Chen wrote: "When designing a machine, engineers tend to be so engrossed in increasing efficiency, aiming for the saving of power and of materials in accordance with the principles of pure mechanics that they always forget that the person standing behind the machine is something to also be regarded." With chapters centered on issues from "environmental factors and efficiency" and "fatigue and rest" to "problems of factory organization" and "stimuli and motivations for work," the book offered reflections on this new field of industrial psychology and its application to the case of China. It was the first book on the subject in Chinese, immediately preceded pioneering studies in industrial psychology that Chen and his colleagues would conduct in factories and other sites of production in subsequent years. In this paper, I examine the development of industrial psychology as a field of study in China from the 1930s to the 1950s, paying particular attention to the ways in which it prescribed adjustments to how workers worked and to the environments in which they worked, all in the pursuit of productivity. In so doing, I consider broader questions from the physicality of labor to the possibilities for psychology as bodily technology in the industrial age.

Symposium (Part 10/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 215

Contribution ID: 546

Science, commerce, and art: the evolution and significance of the microscope slide

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Microscope slides are small but vital elements of the centuries-long use of the microscope and related scientific instruments. However, they have received less attention in the scholarly literature and often also in museum exhibitions than have the apparatus with which they are used.
Slides seem to exist in a liminal space – being a vital component of technology use without being a technology *per se*, bridging the gap between scientific instrument and natural specimen, and typically freezing specimens in time while facilitating ongoing and evolving scientific research with them.
Historical microscope slides sometimes survive as discrete sets and collections with known historical contexts, and sometimes they survive as disparate individual slides which have been torn from their original moorings. Many slides have, of course, not survived at all to the present day.
I will examine the rich centuries-long history of the microscope slide including its evolution in design, materials, and approaches to presenting and preserving specimens. I will also examine the disparate uses of slides from science to art and craft, and their modes of production from private individuals to institutional laboratories to largescale commercial companies.
Finally, I will unpack the different ways in which microscope slides are typically positioned within the history of scientific instruments and within museum use and display. There will be certain parallels

between this and our perceptions and use of other small instrument components or accessories, such as magic lantern slides or interchangeable objectives.

Contribution ID: 873

The IGN instrument Gallery – a collection of threatened instruments

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The French national geographical institute (Institut géographique national, or IGN) inherited and collected around 800 astronomical, geodetic, topometric, and topographical instruments. They date from as early as the 17th century, when they were used for the triangulation of France, the map of Cassini, and military command maps, and up to the 20th century, when they were used for the latest IGN map of France.
In 1940, the IGN was created as a replacement of the Service Géographique de l'Armée (SGA), itself replacing, since 1887, the Dépôt de la Guerre, created in 1688. The name changed, but the missions of the successive national services remained to map the national territory and the colonial empire, to keep the archives (paper and copper plates of the maps), but also to collect instruments to document the professional instrumentation's evolutions. This led to this extremely rare collection, almost exclusively composed of unique instruments, internally designed or purchased from European makers.
Around 2010, the status of the IGN changed from public body to commercial entity, revoking its heritage mandate. Cartographic archives have been transferred to the national archives, but transferring the instruments is problematic. All of the so far possible host institutions have agreed on the exceptional value of the collection, but only consider harbouring part of it, in order to complement their own. The collection's integrity is thus in jeopardy.
This paper will present the context of the constitution of this collection, and through a few example instruments, how the collection integrity enables instrumental genealogy.

Contribution ID: 1279

E-POSTER A paper sky - Planispheric celestial volvelles

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Planispheric celestial volvelles [PCVs] follow in the lineage of Greek astrolabes. Their modern construction out of paper dates from the 18th century. It is during the 19th century that we see mass production of "planispheres" and can attempt to assign to them some cultural role.
PCVs appear to have been first commercialized by George Philip *circa* 1886. The ornate decoration of his planisphere, which serves no function, suggests that these were largely parlor *objects d'art*. "Hammett's Planisphere" clearly is modeled after the Philips. It created a new, professional market for PCVs, the community of teachers.
By the 1920s, PCVs became more utilitarian. Astronomical content in text was printed on the reverse. Examples from the 1930s explicitly target amateur astronomers. In the 1940s, PCVs were made in support of navigation for military pilots.

By 1960, the PCV was repurposed as an aid to finding artificial satellites.
In 1977, David Chandler introduced a two-sided PCV designed to reduce map distortion. Starting with Chandler, the cartographer for the planisphere become a celebrity-selling point.
Perhaps the 20th-century sky events that most resonated with people of the world were the apparitions of Comet 1/P Halley. A unique 1985 PCV was manufactured that incorporated the path of the comet on its star disk.
Today, digital planispheres supplant physical ones. In contemporary mechanical PCVs, we see artists constructing four-color revisionisms that hark back to those of the 1800s, ones based upon aesthetic considerations as much as uranographical verisimilitude. The planispheric celestial volvelle has come full circle.

Symposium (Part 3/3) Evolution of mathematics in China: major figures, anonymous contributors, and the giants among them (ICHM) (with IMU) - ID 70

Contribution ID: 105

Woodsman and commoner: why did Zhao Shuang and Liu Hui become interested in gou-gu methods?

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Contemporaneously in history (approximately the 3rd century CE), Zhao Shuang, a woodsman, annotated the Zhou bi Suan Jing, and Liu Hui, a commoner, annotated the Nine Chapters on the Art of Mathematics. They both showed a common interest in gou-gu methods, the subject of Chapter 9 of the Nine Chapters. Zhao Shuang deduced the quadratic equation and root-finding formulas in his Diagrams of Gou-gu and Circle-square, and in his Diagram of the Height of the Sun he gave a proof of the method for determining the "height of the Sun" based upon relations of geometric areas. Liu Hui also used the method of "double-differences" to solve nine surveying problems that he presented as an additional chapter that he wrote following the gou-gu chapter, the last in the Nine Chapters. This "tenth" chapter was later considered an independent work, and has come to be known as the Sea Island Mathematical Manual.
Why did Zhao Shuang and Liu Hui show so much interest in gou-gu methods? The reason lies in the fact that the gou-gu methods involve the principles of state governance, as this presentation will explain in greater detail. Liu Hui also believed that "the method of double-differences serves to measure heights, depths, and distances simultaneously. The basic principle of the gou-gu method is based on the ratio of the double-differences." This presentation will, in the context of cultural history, explore the similarities and differences between the gou-gu methods of Zhao Shuang and Liu Hui.

Contribution ID: 117

Liu Hui, Jia Xian, Yang Hui, and two problems in the Nine Chapters on the Art of Mathematics: inscribing squares and circles in given right triangles

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The problems of inscribing squares and circles in a given right triangle first appear in the history of Chinese mathematics in the well-known *Jiuzhang suanshu* (Nine Chapters on the Art of Mathematics), in Chapter Nine devoted to *gou-gu* methods for solving problems involving right triangles. These appear as Problems 14 and 15, respectively, and receive detailed commentaries by the third-century mathematician and commentator Liu Hui. Nearly a millennium later, the Song and Yuan dynasty mathematicians Jia Xian and Yang Hui also considered these problems and took new approaches of their own to both problems. Jia Xian was the author of a work that is no longer extant, the *Huangdi jiuzhang suanfa xicao* (The Yellow Emperor's Detailed Solutions of Computational Methods in the *Nine Chapters*), written about 1050 CE during the Northern Song dynasty. Guo Shuchun has argued that a substantial part of this now-lost work may be reconstructed from the later compilation by Yang Hui, namely his *Xiangjie jiuzhang suanfa* (Detailed Explanations of Computational Methods in the Nine Chapters) (1261). This presentation will offer a detailed comparison of the approaches to the inscribed square and circles problems and how they were treated by Liu Hui and his later successors, Jia Xian and Yang Hui, reconstructing the diagrams described in Liu Hui's commentary to illustrate the proofs he offers, and contrasting both his diagrams and his arguments with those that appear in Jia Xian's and Yang Hui's works preserved in Yang Hui's *Detailed Explanations*.

Contribution ID: 122

Some examples of how correctly transcribe characters in the 筭數書 Suanshushu

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Abstract: The 筭數書 Suanshushu is an ancient Chinese mathematical text, which was written on bamboo slips prior to at least 186 BCE, and excavated at Zhanjiashan from the Han dynasty tomb 247 in Hubei province, China. In order to appreciate what ancient Chinese mathematicians were able to achieve centuries before the Common Era, the first step is to correctly transcribe the characters on the bamboo slips. Unfortunately, some of the characters were wrongly transcribed by scholars although these characters are clear and legible, and some of the characters are physically vague and almost illegible because they were buried underground for more than two thousand years and some of the bamboo slips and characters were damaged. This article is to demonstrate how to correctly transcribe the characters, for example, by carefully reading the photographs of the original bamboo slips, by making full use of the context where the character appears, by comparing the remaining strokes of the illegible character with other characters which are possible to have those strokes, and by rearranging the broken bamboo slips, etc.

Contribution ID: 132

Yang Hui's Study of Mathematics in 13th-Century China

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In contrast with the Yang Hui Suanfa 楊輝算法 (Yang Hui's Method of Computation), one of the most important texts of 13th -century Chinese mathematics, Yang Hui's Xiangjie Jiuzhang suanfa 詳解九章算法 (Detailed Explanations of Computational Methods in the Nine Chapters, abbreviated as Xiangjie) has not attracted as much attention. The former has been extensively investigated by the noted historian Lam Lay Yong. Her study is primarily devoted to Yang Hui's mathematics in terms of textual analysis.
Having read the text carefully of the Xiangjie we can better understand how Yang Hui got to know Liu Hui's commentary to Jiuzhang suanshu. In addition, by Yang Hui's explanation of the publication time order of the Xiangjie (1261) and Riyong suanfa 日用算法 (1262), Chengchu Tongbian benmo 乘除通變本末 (1274), Tianmu Bilei Chengchu jiefa 田畝比類乘除捷法 (1275), and Xugu Zhaiqi suanfa 續古摘奇算法 (1275) respectively, as well as of the Xisuan Gangmu 習算綱目(syllabus of learning mathematics) therein, we are able to identify the different target readers of these texts, namely literati or common people.
Thus, this presentation will consider a wide variety of factors in order to explain Yang Hui's study of mathematics, as shown in not only the aforementioned texts collected in Yang Hui Suanfa, but in his Xiangjie as well, all considered in the socio-cultural context of 13th - century Song China.

Symposium (Part 1/2) Symposium_Gender and technological systems (ICOHTEC) - ID 121

Contribution ID: 155
The united states' wireless women of world war I

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During the United States' participation in World War I, women initiated and joined programs to contribute to the war effort. These included classes at universities and women's colleges, and courses sponsored by women's organizations and influential women. While these usually reflected traditional female roles, training in wireless telegraphy was new. Before 1917, licensed female wireless operators comprised perhaps three percent of 6,000 Americans after men in the industry narrowed their access to professional opportunities (Gessler 2014). Improving technology, however, increased demand for wireless telegraphers in the U. S. Army and Navy. This paper outlines the motivations of, and incentives for, those who organized projects to train women as wireless telegraphers.
It is a brief episode in the history of electric media. Beyond Gessler, and a recent article on British female wireless telegraphers during the war (Bruton 2020), scholars have skipped from women cable telegraphers (Jepsen 2000, Müller 2015) and telephone operators (Martin 1991, Cobbs 2017) to the beginning of broadcasting (Hilmes 1997, Halper 2015, Murphy 2016) and amateur radio (Haring 2008). In giving names and agency to some of these women, I highlight some of the "dwarfs" who make the history of radio more diverse than commonly assumed.

Contribution ID: 494

"Not spoke for": rearticulating gender, labor, and technology

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The Farm Security Administration photography program (1935-44) exemplifies how national efforts to document and curate women's domestic work propagated an idealized practice of laboring that allowed non-domestic bodies to control the national discourse. This paper examines the categories of women's work—invisible labor, aesthetic labor, political labor—through the ways their bodies are instructed to work within technological systems that sought to normalize differently-configured bodies while disavowing the discrimination and erasure that normalization simultaneously promotes.
Examining materials from the Federal Writers' Projects, Westinghouse archives, and the Farm Security Administration photography collection, I suggest ways which women have rewritten themselves back into the discourse by reconciling the exploitative and potentiality of technology and modes of self-expression that reframe women's role as users and makers of technology. Building on recent scholarship examining the gendered politics of human-machine interaction by scholars such as Lilly Irani, Neda Atanasoski, Kalindi Vora, and Jennifer Rhee, this paper argues for consideration of the choices of women's technological production and assertion of their own hip within these sources to resist the concealment and erasure of their technological labor. I argue that such approach moves beyond the language of agency to a narrative of self and self-curation to (1) confront our own complicity in the system, (2) contest patriarchal assumption of knowledge authority, and (3) work towards creating a chance to speak and not to be spoke for by others.

Contribution ID: 695

Al Jolson or Helen Tykociński? A controversy over who was the first to give voice to a film

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In 1927, the Jazz Singer directed by Alan Crosland, and starred by Al Jolson, was advertised as the first sound movie, a so-called 'talkie'. Although it featured only two minutes of talk, and fifteen minutes of songs and music played from gramophone disc (movie employed Vitaphone system), its premiere was heralded as the birth of a new era in cinema. However, those two minutes of talk was not the first human voice accompanying a movie picture. Five years before the premiere of Jazz Singer, a short film recorded at the University of Illinois in Urbana, featured a short sequence of female voice belonging to Helen Tykocinski, a wife of Joseph Tykociner-Tykocinski, a professor of electrical engineer. He immigrated to the United States merely few years earlier, but, as he later recalled, the idea of making a sound movie had been wandering in his mind since his early days in native Poland. Only the move to America gave him both stimulus and technical means to carry out his dreams. His system employed recording sound previously turned into modulated light beam directly onto photosensitive film reel, so-called sound-on-film system, later attributed to Lee de Forest.

This paper analyses the process of turning the Tykocnski's concept of sound in film, and his struggle for recognition as the true inventor of 'talkies', both against the fame of Jazz Singer and of de Forest. Finding an answer to this puzzle, would consequently resolves also a controversy, whether the first movie spoke male or female voice.

Symposium (Part 5/6) Transportation History: Modern landborne transport solutions: from roads to hubs (ICOHTEC) - ID 530

Contribution ID: 718

From the atmospheric railway to Hyperloop: pneumatic transport from the 19th until the 21st century

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Since the second half of the nineteenth century, pneumatic tubes have been an important, albeit partly forgotten element in communication and transport infrastructure. Urban networks were used to send telegrams, letters, documents and small objects through the city's underground. Prague had the most long-lasting functioning pneumatic network (until 2002). However, in the past 150 years there were several attempts to develop pneumatic transport systems for people and goods, from the so-called "atmospheric railway" in the mid-nineteenth century to recent projects such as Hyperloop, Pipenet, or the planned transalpine underground pneumatic transport network. Whereas pneumatic tubes could be defined as "dwarfs" in the history of technology, pneumatic railway projects rather appear as "giant" infrastructure projects; as such, they have been posing several challenges. However, in both popularizing and scientific articles, they are presented as an answer to pollution, as a way to reduce traffic and carbon-dioxide emissions, and as an alternative to heavy transport.
I would like to trace the continuities of pneumatic transport projects from the nineteenth until the twenty-first century, showing how nineteenth-century projects and representations of pneumatic transport reemerge or are consciously taken up in twenty-first century engineering and planning. I will argue that the history of pneumatic systems questions the idea of a linear development of technology and that, at the level of scale, the history of "small" systems such as the "rapid mail carrier" and pneumatic tube networks should be understood as being intertwined with the development of "giant" transportation projects such as pneumatic railways.

Contribution ID: 728

Making transportation easier and faster for whom? The emphasis on automobility of post-war traffic engineering and its appropriation in Portugal

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The post-Second Word War "americanization" of Europe, which materialized not only in economic, political or military terms, but also via a science and technology agenda, was underpinned by an interactive dialogue between USA and Europe (Krige, 2006). American influence on the circulation of knowledge of traffic engineering was appropriated in several European countries by a technical elite, for example, through grants from the International Road Federation (IRF) for attending university courses, internships in federal agencies of U.S. roads, as in Swedish and Norwegian cases (Blomkvist, 2004; Lundin, 2004; Østby, 2004; Seely, 2004), or participating in international conferences and seminars (such as the Permanent International Association of Road Congresses (PIARC) traffic engineering weeks).
Using sources on the circulation and appropriation of traffic engineering in Europe and particularly in Portugal (namely in England – UK National Archives; seminars in professional organisations – PIARC archives; and on Portuguese highway engineers professional folders who were trained as traffic engineers – Portuguese archives), this paper discusses how Portuguese highway engineers appropriated traffic engineering' concepts (for example, in the plans to build motorways in the metropolis in the 1950s; and its relation to the E-roads) and how these concepts aimed at making easier, more direct, and faster transportation for motorised transport met critics that stated it contributed to the rise of private motorised automobility, excluding other mobility modes from their projects, promoting a limited approach to planning, and contributing to the increase of regional asymmetries.

Contribution ID: 887
Transportation hubs: new public spaces for the city

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In their indispensable and continuous reform, cities must take advantage of their stations. These are elements of urban regeneration as they are key parts in the city´s structure, organizing their mobility and representing large areas of local development. With the evolution of transport systems, it is common for terminal station buildings to become obsolete and require a complete transformation, just as the uses and configuration of adjacent urban areas change.
Drawing on their centrality and accessibility, these buildings and their large areas of railway tracks and facilities, located around them and coming from abandoned modes of exploitation, become opportunity areas to recover the city. They allow more sustainable urban and building projects with mixed uses where large public spaces are incorporated either on the station rooftops, inside them or in their surroundings. These places are designed integrally with the buildings, obtaining multifunctional spaces that provide leisure and activity for both public transport users and local residents.
Accepting that each city is unique both for its history and for its location, population and level of development, various city examples with different performance criteria undertaken in urban transformations are studied. As case studies: King´s Cross-St. Pancras, London Bridge and Transbay Transit Center, core elements in the last restructuring of public transport in London and San Francisco, respectively. The aim is to reveal that the station functions in the city and the opportunities they offer to improve their influence areas go far beyond what their mere functional reform anticipates.

Session XX - Genetics

Contribution ID: 1103

Neither giants nor dwarves: eugenic family studies and the quest for the "normal" citizen in interwar Czechoslovakia

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In interwar East Central Europe, eugenics was entangled with nation-building. After the collapse of the Habsburg Empire, Czech eugenicists set off on a quest to define the new Czechoslovak citizen. In one of their key projects of the 1920s, they singled out the Pejša family of Southern Bohemia as their object of research. The project followed American eugenic family studies as a model, particularly Goddard's research on the Kallikaks. Eugenicists collected genealogical and anthropological data to trace the allegedly hereditary features passed on in a family through multiple generations. Unlike these family studies, however, Czech eugenicists did not aim to conjure up a spectre of increasing degeneration. On the contrary, these eugenicists tried to prove that the Pejša family embodied average citizens of the new state who, moreover, had inborn potential for moderate economic and social development. Ultimately, their research thus attempted to define a "normal" subject of emerging Czechoslovakia in biological terms. Ironically, during the research it turned out that the normality of the Pejšas was quite exceptional. Drawing on Georges Canguilhem, the emerging biosocial turn in sociology, and the Actor-Network Theory, my paper will use the example of the eugenic research on the Pejša family to explore the meanings of normality in interwar Czechoslovak political culture.

Contribution ID: 1201

Mendel Memorial Symposium 1965 – The event of genetics between the past, ideology and its modern development

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International "Mendel Memorial Symposium" was held in Czechoslovakia in August 1965 to mark the 100th anniversary of the public presentation of Mendel's experiments on heredity and was visited by 925 scientists from both sides of the Iron Curtain. All the Soviet block countries suppressed classical genetics and promoted Lysenkoism during the early 1950s, this situation was gradually changing with the destalinization, and it was finally suggested to the International Union of Biological Sciences by the Czechoslovak Academy of Sciences in 1958, that the anniversary of Mendel's work should be celebrated in Brno. The four-day-long programme included fifteen invited lectures dealing with the origin, the development, and the application of genetics, opening the Mendel Memorial, excursion to Mendel native village Hynčice, etc. This celebration event meant among other things a satisfaction for many scientists from the East and the symbolic final evidence of the end of the Lysenkoism era. The follow-up programme continued in Prague by "Symposium on the Mutational Process". Four working parallel sessions organised by the recently established biological institutes of the Czechoslovak Academy of Sciences and the Slovak Academy of Sciences completed the several-year strategy of cooperation between biologists from the West and the East and reflected completely current issues in connection

with the development of molecular biology and genetics. Therefore, it is opportune to describe the preparation, the agenda, and the course of the most significant conferences to date commemorating Mendel's legacy and discoveries.

Contribution ID: 1144

Sketching an "Andean race" through early-twentieth-century scientific diagrams of the "Mongolian spot"

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This paper explores the role that scientific drawings and diagrams played in modern theories of the existence of an "Andean race" as a supposedly visible, material and biological fact. In late nineteenth and early twentieth century, European travelers and scientist struggled to racially classify South American phenotypes that with immensely diverse skin colors and features, remained elusive to typification. This presentation focuses on one specific bodily feature known as *mancha Mongólica* or Mongolian spot: a dark bluish blotch that appears on the lower back of newborn babies and fades away during early childhood. This birthmark— to date deemed evidence of the presence of indigenous blood in South American countries—was drawn and sketched in attempts to find generalizable patterns that would ultimately help solve the Andean "racial enigma." Even when Anthropology has long established that race has no biological existence, people experience and understand race as a biological reality with correlation in physical appearance. This presentation claims that scientific drawings, that aimed to uniformize and systematize the Mongolian spot, ultimately made signs on Andean bodies readable as "race." These scientific images participated in a historical process that made race visible, assumed relations between visible appearances and interior essences, and attempted to conceal or defuse the reality of racial hybridity in young Andean nations.

Contribution ID: 1069

Erotetic Aspects of the History of Classical Genetics

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According to the so-called "traditional account" (Olby 1979), "orthodox image" (Bowler 1989) or "official story" (Lorenzano 1997), "classical" genetics developed in a *continuous*, *cumulative* and *linear* way. Critics of this interpretation emphasize the *discontinuities*, *losses* and *ruptures* of this process.
In other works (Lorenzano 2007, 2008) I tried to analyze the relationship between the proposals of Mendel, of the "rediscoverers"—de Vries, Correns and Tschermak—, of Bateson and collaborators and of Morgan and disciples, e.g. the history of "classical" genetics, in such a way as to capture and specify both the idea that among these there are certain discontinuities and ruptures (of the type pointed out by the detractors of the "official story" of genetics) and that these have "something" to do with each other in some way (and which would allow us to understand the existence of this "official story"), focusing basically on its conceptual aspects.

In this communication, I continue this analysis, but focusing now on its *erotetic aspects*, that is, on the aspects related to the *questions they intend to answer with their research*, as well as the *answers they consider admissible*.
To this end, I will use a modified version of the proposal made by Matti Sintonen (1985, 1996) to specify the problem-solving approach (Laudan 1977, among others) by means of the "structuralist view of theories", through which a more precise characterization of the theoretical context in which the problems are posed and, thus, of their individualization, is achieved.

Contribution ID: 1106
Once upon a time in the Cold War: the construction of molecular genetics of bacteria in Mexico

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One challenge of the global history of science is to clarify how scientific practices, ideas, teachings, materials and even scientists themselves circulate without an Euro-American narrative. Also, to be a successful practice, science must travel to other regions through collaborative networks as these cross any division, whether geographical or political. This work addresses the construction of the first practices of molecular genetics of bacteria in Mexico during the 60s and 80s of the twentieth century using the global history of science. To this purpose, I used collaborative networks and circulation of knowledge as analytical units of history. Likewise, I used sociohistory to investigate how the standardization of this knowledge took place, in which two practices that were relatively new in Mexico, molecular biology and bacterial genetics, were fused in the manner of epistemic cultures. The history of microbiology has played a neglected role in the historiography of the life sciences in comparison with topics such as evolutionary theory or human genetics. Although this new global historiography has been taken as a response to other models in the history of science, it has also been looked at with a certain reserve, as it has some limitations that are important to mention. For all these reasons, I have focused on crafting a historical narrative that explains, in a brief but concise manner, how was constructed a field of knowledge that launched Mexico into the vanguard in the last years of the Cold War.

Symposium (Part 3/3) CHCMS (History of Chemistry and Molecular Sciences) - ID 1296

Contribution ID: 1306
Vanadium: A History of Mexican Chemistry

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While historians of science emphasize scientists in Europe, such as Marie Curie and Alexander von Humboldt, scientists in Latin America rarely receive a mention. Historians of Latin America, meanwhile, discuss indigenous medical-botanical compendiums or emphasize traveling scientists in the late

nineteenth century. Using letters and scientific treatises, this project fills this gap by examining the work of Andrés Manuel del Río (1764-1849), chemist, geologist, and director of Mexico's National School of Mines. This research argues that Del Rio encountered a backlash to his 1801 discovery of the element vanadium because it coincided with political upheaval and geopolitical struggles of the Wars of Independence (1810-1821) in Mexico, emphasizing rifts and a break with colonial centers.
Using letters, scientific association minutes, and archival documents, this research shows how the very active scientific community shaped the new republic. I examine how scientific institutions withstood the political turmoil of the era in Mexico. It begins by exploring the political ties between the Crown and the institutions before independence with a focus on chemistry. I also discuss how science institutions against early republic governments who were eager to dismiss the old guard. Lastly, the goal of this research is to challenge the paradigm of chemistry having existed solely as a science in European laboratories.

Contribution ID: 1307
Chemurgy: Agricultural Engineering in Republican China and the American Midwest, 1925-1935

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In the late 1920s, the field of industrial chemistry was in a nascent state in China. After completing graduate work in Japan, the US, and Europe, the few returning practitioners primarily centered around research universities in Shanghai, Nanjing, and Beijing. Since the fall of the Qing empire in 1911, the Chinese state had been conspicuously absent from investment in applied sciences. This changed as the Nationalist party took power in 1927-28 under Chiang Kai-shek. Within a few years, spurred by an increasingly aggressive imperial Japan, the Chinese state began significant investment in state funded research labs and large-scale chemical plants.
This paper focuses on two Chinese scientists, microbiologist Wei Yanshou and chemist Gu Taosheng, who completed graduate studies in US agricultural colleges in the early 1930s. While the state of agriculture in the US obviously differed greatly from that in China, the Great Depression and its global effects caused agricultural engineers in both countries to rethink their approach to farming practices and the use of agricultural surpluses - - one line of research in particular, known by the mid 1930s as "chemurgy", sought to use surplus grain output for useful products like "gasohol", an ethanol-based biofuel. Despite support from industrial boosters like Henry Ford, the "chemurgy" movement largely failed in the US, while the use of biofuels became widespread in China during the 1940s.

Contribution ID: 1308
Chemical information and the history of modern chemistry

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Chemistry is everywhere; everything is chemistry. Just ask any chemist, or industry lobbyist, or environmental justice activist, or "neo-materialist" humanities scholar. Looking upon a world made legible through modern chemistry and the molecular sciences, this seems obvious. Even scientific and

bureaucratic boundary-drawing ("nanomaterials" science, "biologic" drugs, "UVCB" substances) honors the ubiquity of chemistry in the breach. Like anything else, "everything is chemistry"—the ideas, practices, instruments, and institutions that together constitute modern chemistry's universality—has a history. This history is the subject of my talk, drawn from my book in progress, Compound Words: Chemical Information and the Molecular World. Spanning the late eighteenth century through the present, Compound Words takes up chemical information—technologies and practices by which chemists organize, find, and access published research results addressing material substances and their uses—as source base and subject matter for both tracing and explaining modern chemistry's ever-waxing material scope. Shedding light not on a particular method, idea, or institutional arrangement characteristic of chemistry but on the unity and ubiquity of chemistry as a whole, the study of chemistry's "information history" (as we may call it) and its "literature chemist" protagonists interconnects and complements histories of instruments, theories, chemical formulas and equations, manufacturing enterprises, research schools, and so on. By way of introducing information history as method and subject matter, this talk will zoom in on one pivotal moment in this history, post-World War II efforts to rescue chemistry's canonical printed reference works.

Contribution ID: 1310
Comment and general discussion

Brigitte Van Tiggelen
Science History Institute, Philadelphia, United States

Comment and general discussion

Symposium (Part 1/2) The role of universities in Soviet science - ID 222

Contribution ID: 296
E-POSTER From initiative to plan. Features of the organization of scientific research in Russian universities of the Imperial and Soviet periods

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The purpose is to trace the changes of the research setting at Russian universities from Imperial to Soviet times.
The infrastructure of Russian science before the revolution consisted of the Academy of Sciences, universities, higher education institutions (HEI) of other types, scientific societies. Due to the small scale of the Academy and the applied nature of HEI, in the pre-revolutionary period science in Russia was mostly university. The development of science at universities was determined by the scientific groundwork, instrument base and the initiative of professors. The government bodies poorly regulated scientific research. However, the authorities treated the social sciences with caution.
When comparing the imperial period with the Soviet period, both common and various features are striking.

Common features – development of scientific directions laid down in the 19th, the preservation of the principle of the unity of science and education, state's control over social sciences.
Differences. The share of university science began to decline, since in the XX the Academy and applied industrial science gained more weight. State funding for science has grown (despite the private donations have remained in the past). Science in the USSR developed in isolation from the Western world, which differs from the previous era of close scientific ties. Ideological control over scientific research and scientists was increased. State research planning has begun that predetermined the appearance of scientific studies in universities of the XX.
In the report these phenomena and trends will be illustrated by cases from the history of various Russian universities.

Contribution ID: 308
Molecular biology in Soviet universities in the early 1960s

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The renewal of genetics in the Soviet Union in the early 1960s is now well-documented (Shalimov, 2011). Since genetics is a mandatory ingredient of molecular biology, the latest science also enjoyed more support which lead to the creation of the scientific journal *Молекулярная биология* (*Molecular Biology*) in 1967 (Nauka, Moscow). Scientists involved in the institutionalization (laboratory, journal, …) of molecular biology in the Soviet Union were members of the USSR Academy of Sciences like Vladimir A. Engelhardt (member, 1953) or Alexander A. Bayev (corresponding member since 1968, member since 1970).
In this communication, thanks to Soviet scientific journals, the share of Soviet Universities during the early days of molecular biology in the Soviet Union is assessed. A comparison with France, where molecular biology enjoyed since 1960 a specific State support and then was "passed" to the CNRS (Gaudillière, 1991 ; Polanco, 1990), will be made.

Bibliography

Gaudillière, Jean-Paul. *Biologie moléculaire et biologistes dans les années soixante: la naissance d'une discipline, le cas français.* PhD thesis, Paris VII University, 1991.
Polanco, Xavier. "La mise en place d'un réseau scientifique. Les rôles du CNRS et de la DGRST dans l'institutionnalisation de la biologie moléculaire en France (1960-1970)". *Cahiers pour l'histoire du CNRS*, 1990: 7. https://www.vjf.cnrs.fr/histcnrs/sommaire-cahiers.html [Accessed May, the 17th 2020]
Shalimov, Sergey. "Spasenie i vozrozhdenie": Istoricheskij ocherk razvitija genetiki v Novosibirskom nauchnom centre v gody "ottepeli" (1957–1964) [Salvation and rebirth: a historical essay on the development of genetics in the Novosibirsk scientific center during the «Thaw» (1957–1964)]. Novosibirsk: Manuscript Publishing House, 2011.

Contribution ID: 628
Science studies in the Soviet Union

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In comparison with imperial period science in Russia underwent a dramatic change which concerns the fact that science acquired new institutional structure. It is well known that Soviet science was divided into three «institutional regions»: Academy of sciences, higher education (universities and institutes) und sectoral institutions (both sectoral academies and institutes). While universities were oriented to basic science and produced scientists, educational institutes aimed at producing engineers for correspondent sectors of national economy. Although this understanding of Soviet system of education is schematic, it reflects general structure of Soviet academia. In our presentation we plan to speak about science studies in the USSR, taking into consideration the above described institutional structure. We show that the Academy of sciences of the USSR should be considered as a leading institution of Soviet history and philosophy of science. The Institute for the history of science and technology was the center of the science studies in the USSR. It was S.R. Mikulinsky, a director of the IHST, who established new field of studies – naukovedenie. Under his directorship soviet history of science experiences its heyday. Nevertheless, science studies was also represented with a number of scholars who worked in universities and educational institutes. In our report we focus on general description and evaluation of the works by such scholars M. K. Petrov, G. P. Shedrovitsky, I. A. Boritscevsky, B.M. Gessen, V. I. Vernadsky and others. We will try to give a general outline of the science studies in the USSR with emphasis on university science.

Contribution ID: 928

The value and the role of the universities in the development of scientific schools and research areas: the experience of Tomsk universities in the 20th century

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The establishment of the first university in the Asian part of the Russian Empire in 1888 had substantially transformed the development path of the region. After Tomsk Institute of Technology had been founded in 1898, two universities became involved in large-scale socio-economic and infrastructure projects: the construction of the Trans-Siberian Railway, field studies of natural resources and indigenous peoples of Siberia, Central Asia and the Far East.
This paper will focus on the analysis of key chronological points in the development of Tomsk university complex: the pre-revolutionary period (the emergence of school of thoughts and scientific expeditions across Siberia, Central Asia), the period of the Civil War - the first half of the 1920s. (activities of the Institute for Siberian studies), the second half of the 1920s. - 1930s (transformation of science and education policies, participation in the industrialization of Siberia), World War II – the second half of the 1940s-1950s. (demilitarization of science), 1950s - the first half of the 1980s. (cooperation of universities, the emergence and development of new schools and directions in academic research), Perestroika (1985-1991 (a period of changes in the organization of research), 1990s - the first half of the first decade of the 2000s. (transformation of science and education paradigm).
A particular emphasis will be placed on the analysis of historical dynamics of the university model of organizing and developing research and education, the impact and role of Tomsk universities in the development of new school of thoughts, the socio-cultural and economic development Russia.

Symposium (Part 3/4) Mathematical proofs and styles of reasoning: East vs. West - ID 73

Contribution ID: 230

Mathematical rigour, mathematical creativity, and the transgression of limits

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Dignity and highest certainty are the characteristics of mathematics guaranteed by rigorous demonstrations. The Ancients or – to be more precise – Archimedes were and remained the touchstone for the legitimacy of mathematical methods, objects, proofs until the times of Euler. In order to demonstrate the equality of two quantities the double *reductio ad absurdum* was usual and necessary. Yet, thanks to Archimedes's letter to Eratosthenes we know that he transgressed limits of legitimacy when he looked for the solution of problems. His demonstrations were criticized because of their obscurity. Hence tried to replace them by affirmative demonstrations. In 1615 Kepler explained Archimedean theorems in his *New solid geometry of wine barrels* using geometrical transformations and analogies thus being able to surpass the results of the Greek author. Was he entitled to do that? In 1641 Guldin spoke of Kepler's new method of demonstrating. Guldin himself claimed to give clear and perspicuous demonstrations instead of the too obscure Archimedean demonstrations. When in 1676 Leibniz amply used infinitely small and infinite quantities in his *Arithmetical quadrature of the circle* etc. he admitted that this might appear obscure, but he emphasized that they provide abbreviations of speaking, thinking, discovering, and demonstrating and that his method differs from the Archimedean style only by the expressions. In 1755 Euler tried to justify the use of these quantities in another way. But he was convinced that the highest geometrical rigour was observed like in the books of the Ancients.

Contribution ID: 268

"Proofs as Games?" Frege vs. Hilbert and Wittgenstein

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Gottlob Frege (1848-1925), one of the founders of modern logic, was profoundly convinced that his approach of *significant* ("*inhaltliche*") arithmetic and geometry is diametrically opposed to a purely *formal*, *game-oriented* understanding by Carl Johannes Thomae (1840-1921) and the *axiomatic* foundation of geometry by David Hilbert (1862-1943). Hilbert's *Grundlagen der Geometrie* (1899) marks the starting point of a short correspondence (27.12.1899-22.09.1900) between Frege and Hilbert and two series of papers by Frege on this topic in 1906 and 1908 after publishing the second volume of his *Basic Laws of Arithmetic* in 1903. Frege was not willing to accept Hilbert's *implicit* definitions of geometrical concepts by groups of axioms, his *proofs* of *consistency*, *independence of axioms* and the *distinctness of formal systems*. Frege was upset about Thomae's heavy use of *chess analogies* to demonstrate his *formal* understanding of arithmetic following Hermann Hankel (1839-1873). There are many passages in Frege's *Basic Laws* II refuting Thomae's ways of looking at mathematics from the perspective of chess. This highly emotional discussion continued in 1906 and 1908.

Our questions are: What are inspiring analogies between (elements of) proofs and corresponding aspects of chess? What are the limits of such analogies? We get support from Ludwig Wittgenstein (1889-1951). He is famous for his later philosophy of *language games*. Starting in 1929 he uses an amazing amount of *chess analogies* in many interrelated respects, among them in the context of his *philosophical* discussion of different types of proofs in and against the spirit of Frege and Hilbert.

Symposium (Part 1/2) Reading the skies: exploring the intersection of ethnometeorology, folk traditions and meteorology (Commission on the History of Meteorology) - ID 416

Contribution ID: 572

Folk meteorology in spanish philippines: Indigenous views on weather, climate, and the environment in the philippines, 16th-19th century

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Several studies in the Philippines in the previous decades provide a scholarly (re)opening to revisit and comprehensively reconstruct the history of ancient Filipino worldviews and indigenous perspectives on the environment. Some of these include the pioneering study of Ambrosio (2010) on the Filipino indigenous views about the sky and the heavenly bodies and the work of Aguilar (2016) on how the Filipino *ilustrados* in Spain represented Philippine tropicality in their propaganda writings.
This paper presents a historical survey of the Filipino indigenous views on weather, climate, and the environment in Spanish Philippines. Using archival materials such as missionary accounts and dictionaries from the late 16th to the 18th century, and the bibliographical compilations and writings produced in the late 19th century, this study will further expand the understanding, such as the diachronic description of the evolution of weather reading during the Spanish colonial period. Reconstructing the local cultural worldviews enhances the understanding of scientific development and the spaces where Western and Filipino indigenous science meet. This research attempts to contribute to the study of indigenous/folk science, focused on meteorology and environmental phenomena.

Contribution ID: 573

Weather and Religion in Europe in the Vulgar Era: the Meteo - providential Saints

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Ancient Greeks and Romans often linked meteorological events to the action of various divinities and turned to them to obtain an intercession, despite the first studies of Aristotle on the meteorology.
With the spread of Christianity and the end of polytheism and the consequent disappearance of the gods who dealt with meteorological events, the ordinary people often tended to attribute the responsibility for bad weather to the devil. The Church could not accept these beliefs because in contrast to monotheism and therefore from the sixth century it took a position stating that the power to cause meteoric events belongs only to God. The Church, however, accepted over time, with various beatifications and

sanctifications, the "specialization" of saints and blessed, in intercessions with the Eternal Father, for meteorological miracles and graces.
In agro-pastoral field, by changing Latin traditions, rogations were celebrated for centuries in order to protect crops from adverse weather events. Over the centuries, therefore, it was witnessed the birth and spread of these devotions, so much so that the Pantheon of Meteorophile Saints, includes those in charge of obtaining rain or to stop it, those against hail, storms, floods, drought etc. Rites associated with meteo-providential saints span several centuries and are part of the intangible European tradition. Although devotion in most of Europe has grown less and often only a few manifestations remain at the folkloristic level, the mass media, still today, report some processions or rites to obtain divine intercession to combat drought or to stop the rains.

Contribution ID: 619

Weather lore and meteorology in the notes of Jan Strialius of Pomnouš (1535/1536-1582)

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The practice of weather recording in Europe has developed since the late 15th century to be more consistent. Some of the observers wrote down weather for example in connection with data of an economic nature, others were true observation experts, for whom the weather itself was of interest and examination. This second group includes the humanist scholar Jan Strialius of Pomnouš (1535/1536-1582), whose interest in weather is evidenced also by his notes in a copy of Jakob Milich's commentary on the second book of Naturalis historia by Pliny the Elder, on the basis of which the meteorology was taught at Wittenberg University, where Strialius studied.
Strialius noted his visual observations of the sky into the Stadius' Ephemerides in three languages for almost 25 years and left thus a great source of data for Czech historical climatologists, who have already paid him deserved attention. Next to common phenomena such as rain or frost, and the general weather character of the day, he recorded phenomena he intended to explore more such as aurorae, comets, windstorms, or halos. He was obviously interested in the dependence of sublunar phenomena on the effect of celestial bodies, their eventual connection with certain moments of the year and their role as harbringer of future events. His notes are thus a real interconnection of weather observing, weather theories and weather lore and that is why we would like to focus on them in the context of the meteorological ideas of his time.

Contribution ID: 631

The meteorological knowledge and beliefs in ancient Greece in "Diosemeia" of Aratus

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In Helenistic world, the most interesting works describing beliefs concerning weather forecast were certainly Aristotle's *Meteorologica* and *On Weather Signs* traditionally ascribed to Theophrastus of Eresus, containing the most complete list of such signs in antiquity. The third one may be *Diosemeia* a long didactic poem written *c.* 270 B.C. by Greek poet Aratus of Soli (*c.* 315 B.C.-*c.* 240 B.C.) as a part of his poetical work *Phaenomena.* This work is interesting for study of the beliefs and methods for weather forcasting in ancient Greece particularly since the materials for it are taken from the two mentioned works of Teophrastus and Aristotle as well as from the poem *Works and Days*, Hesiod's most famous work which includes some advices for weather forecasting.
The *Phaenomena,* the oldest entirely preserved astronomical text in Europe, contains a description of the constellations and of the most important circles on the celestial sphere, enriched by the related myths and stories. Astronomical content is based on the now extant work with the same title of Eudoxus from Knid.
The second part, *Diosemeia* consists of forecasts of the weather and wind on the basis of meteorological knowledge and beliefs. Consequently, this is one of the best sources to study how people in ancient Greece used to attempt to make weather forcasts from astronomical phenomena and various effects upon animals, birds, insects, plants and other "signs of God" in their environment. The analysis of these methods will be the subject of this contribution.

Symposium (Part 1/5) Art, image, and astronomical knowledge (ICHA/CHAMA) - ID 184

Contribution ID: 518

What can Neolithic imagery convey about bright stellar transients?

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The Neolithic epoch is rich in images of creatures painted on cave walls and ceilings, carved in stone, laid out as mosaics. In addition to animals, other natural objects depicted include celestial bodies (the sun, stars, constellations, etc.). My colleagues and I have studied a stylized eight-point star (八角星, bajiaoxing), found in various guises at sites in central China with ages ranging from about 4,000 to some 8,000 years. The star, inscribed or painted, consists of two pairs of parallel lines, crossing orthogonally. Four v-shaped figures link the outer ends of adjacent pairs, forming eight points. There are several indications that the object depicted was celestial in nature, and we suggest that it was a bright star. Specifically, it could have been a nearby nova or supernova, and in particular one of several associated with supernova remnants of estimated age ca. 8,000-15,000 years. With no written record, we are compelled to extract what information we can from the context of the artefacts excavated, in combination with modern astronomical investigation of the explosion's aftermath. The earliest sites are found in southern China (Hunan Province), and our favored supernova candidate generated the Vela remnant and was unobservable from the north. I will discuss what other information can be teased out of Neolithic artwork, how reliable it is as "eyewitness" observing, and how to best interpret imagery emanating from a culture so foreign and remote from our own as the stone age.

Contribution ID: 339

The Many Face(t)s of Comets in Early Modernity

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As frightening and impressive phenomena, comets in the early modern period encouraged intensive communication processes as reflected, for example, in vernacular pamphlets. In the 16th century, comets were seen as ephemeral meteorological phenomena of the upper atmosphere, while they were regarded as celestial bodies with predictable motion by the end of the 17th century. Since recent scholarship has shown that cometary superstitions and religious beliefs were constitutive in this change of cometary knowledge and interpretation, my paper examinates if and how this development is reflected in visual representations like images or diagrams of German pamphlets and broadsides on comets in the crucial period between 1530 and 1680. First, I want to discuss what different functions these images fulfilled: They were used to seek and create attention in order to attract an audience and they offered explanation and meaning production by visualizing observational, natural philosophic, astrological and historical data which was then used to popularize different ideas about comets. Furthermore, by showing how different ways of presenting cometary data and meaning were related to certain interpretive frameworks of natural philosophic theories, prognostication and divination, I want to elaborate on to the ambiguous character of the knowledge on comets between stability and progress in order to emphasize that the process of change cannot be adequately described as a linear process of rationalization and naturalization.

Contribution ID: 553

Mount Taranaki, the great comet of 1882, and the genesis of cometary photography in New Zealand

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MOUNT TARANAKI, THE GREAT COMET OF 1882, AND THE GENESIS OF COMETARY PHOTOGRAPHY IN NEW ZEALAND
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The collections of the Alexander Turnbull Library in Wellington include an 1882 photograph that shows the Māori settlement of Parihaka and in the background snow-capped Mount Taranaki and the Great Comet of 1882 (C/1882 R1). There is debate over the authenticity of this photograph and, like others, we believe the comet was a later addition. This then raises two interesting questions:
(1) Why add a representation of Comet C/1882 R1 (or any comet) to the original photograph?
(2) Assuming the comet in the photograph is an 'artifact', when was the first successful photograph of a comet taken in New Zealand?
In this paper we will attempt to answer both of these questions.

Re Question (1), during the 1880s, Parihaka was one of the largest and most important Māori settlements in New Zealand, and one of its founders supposedly was associated with comets. We will explore this linkage, and the basic tenets of Māori cometary astronomy.
Question (2) will involve examining the application of photography to New Zealand astronomy during the second half of the nineteenth century, and reviewing major naked eye comets visible from New Zealand that were capable of being photographed.

Symposium (Part 3/3) Science and literature in small and large scales (Commission on Science and Literature) - ID 273

Contribution ID: 724

The evolution of scientific instruments as a history of intersecting lives: Literature representations of the scientific progress at the 16th century Astronomy

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The man who attempted to measure the heavens some decades before the emblematic Galilean attempt with the telescope, was the legendary Tycho Brahe. He invented and created several huge scientific instruments in order, either to measure certain astronomical incidents occurred at that time or to interpret and confirm innovative approaches on astronomical aspects.
The details of his personal life have been extensively examined and several novels have been written focusing on his family life as well as certain aspects of the scientific achievements he gained relatively with his personal attitude with people close to him.
We intent to confront Tycho's evolutionary efforts for accurate measurements with the scientific instruments he created within a frame of personal relationships either with scientists (such as Johann Kepler) or with people who were close to him (such as the dwarf Jep who lived several years very close to him). We will present literature representations of the era and the people involved respectively so that we face the intersecting lives of all them contributed alternatively for the evolution of astronomical instruments which led Astronomy at the end of the 16th century.

Contribution ID: 759

«Greek Gifted Students' Emotional, Social and Academic Experiences: A Qualitative Analysis»

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Gifted and talented children, as anything unique and exceptional, are usually treated as a "phenomenon" for further research. The existing studies focus mainly on how parents and teachers perceive giftedness. The children themselves remain «terra incognita». They are the exceptions that prove the rule of the non-different people in a world in which actually "different" people might not be able to find their place.

This research focuses, through interviews, on gifted and talented children from various areas of Greece. Children who excel in the fields of astronomy, music, mathematics, literature and sports. The main subject of this study is the gifted children and how they perceive themselves and their individual abilities or skills. The dominant point of the research is the way they experience this reality, their relationship with family, friends, and how their giftedness affects their aspirations, their future and generally their lives.

Keywords: Gifted characteristics, experiences, qualitative analysis

Contribution ID: 1246

The problem of scientific terminology in Lady Welby's significs

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Lady Victoria Welby (1837-1912) is a little-known author of the concept of Significs, the theory of significance. In addition to her works on meaning, there is published correspondence between Welby and contemporaries, including Charles Peirce, Bertrand Russell, Michel Bréal, Henri Bergson and others. This correspondence makes it possible to demonstrate the development of collective philosophical projects: discussion of publications of scientifical dictionaries and scientific terminology. French philosopher André Lalande considered Welby's works as part of the terminological movement in Europe. Welby really worked in this direction, established an award, which was won by Ferdinand Tönnies for work on the development of philosophical and psychological terminology. Lalande did not include in the Technical and Critical Dictionary of Philosophy (1926) the notion of Significs as a theory of significance, preferring de Saussure's semiology. Welby did not receive due recognition among the theories of meaning.

But there is an indirect influence of Welby on the subsequent development of the problem of the unity of science and the unification of the language of philosophy through Tönnies on Otto Neurath and Rudolf Carnap. Tönnies addresses the problem of building a single language of science, analyzes the actualization of the Latin language and comes to the conclusion that English will take a leading role in universal communication.

The report proposes to consider the evolution of the terminological movement in the context of the theory of Welby, the author, which remained in the shadow of the "giants" of science, but had a significant impact on terminological issues.

Contribution ID: 737

The Doctor - Poet Miltiades Emmanuel (1825-1916), the dengue fever in the city of Smyrna in Asia Minor and a satirical poem

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At the end of the 19th century, Smyrna (today called Izmir) was a cosmopolitan city of Asia Minor in the territory of Ottoman Empire and one of the largest ports in the Mediterranean Sea. According to the

census of the British Consulate in 1891, Smyrna had a population of 207.000 people. Many ethnicities (Greeks, Turks, Armenian, Hebrews and Levantines) lived in the wider area of Smyrna with the Greeks being the largest population group with 80.000 people.
In 1889 Smyrna was infected with dengue fever (in the Smyrna's linguistic dialect the dengue fever was called *"daga"*), the epidemic raging in the south-east Mediterranean (Syria, Constantinople) spread to the Greek Kingdom with 10.000 cases in the city of Piraeus.
Doctor Miltiades Emmanuel (1825-1916) was one of the most famous and important doctors in Smyrna at that time. He had studied medicine at the University of Montpellier and received the medical specialization as a pathologist. In addition to medicine, Miltiades Emmanuel was an important poet of Smyrna, many poems of his had been published in Smyrna's newspapers.
Concerning the cause of dengue fever, he wrote a satirical poem which likened the dengue fever to "a lady" that came to Smyrna and with "great courtesy" visited both younger and older people.
At the end of the poem, all the citizens thanked the "lady daga" and wished her "a nice trip", after the good she had done to them.

Symposium (Part 1/3) Interactions and interchanges in the history of science, technology, and medicine - ID 151

Contribution ID: 390
Symposium Introduction and overview

Hugh Slotten
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Slotten's presentation will introduce the Symposium and the major themes that will be discussed. He will analyze especially the theme of the role of indigenous people in the history of science. Slotten will provide a broad historiographic overview of the topic, discussing research from different regions of the world. Recent scholarship has emphasised that local people in all parts of the world not only gathered information but also helped categorise and conceptualise the information. Distinctions between amateurs and professionals as well as producers and users are no longer sharply conceived. Slotten will then close his presentation with a discussion of the implications for the history of science in New Zealand, where the indigenous Polynesian people, the Māori or tangata whenua — the people of the land – continue to play a central role in the country's development.

Contribution ID: 594
Collecting, classifying and constructing nature: indigenous knowledge and the naming of species in the Pacific, 1768–1782

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The late 1760s saw a rapid acceleration in the discovery of species deemed new to European natural history. This inspired the development of unified approaches to naming, recording and classifying

nature. Among the main sources of new species was the first circumnavigation of James Cook between 1768 and 1771, on which Joseph Banks, Daniel Solander and their team of seven assistants recorded, classified and collected information on thousands of species they encountered according to the Linnaean system.
This talk examines the complex array of paper technologies used by Banks's team to order, record and transfer information across a variety of different formats. These were compiled from field notebooks, Solander's 'manuscript slip catalogue' that took a similar format to index cards, images and annotated printed books. In addition to their own observations, knowledge obtained from indigenous inhabitants of the Pacific was central for formulating and ascribing Linnaean names and descriptions to new species. Many of these were translated from indigenous terminology, information transcribed by Herman Spöring into Banks's and Solander's interleaved copies of Linnaeus' *Systema Naturae* and *Species Plantarum*. Banks's and Solander's Linnaean names held their origins in indigenous uses of plants and animals, etymological roots that persisted through the consistent reediting of these descriptions by European naturalists as new source material presented itself in the decades after they returned to London.

Contribution ID: 796
Implementing global health policy: eradicating smallpox in Nepal

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Smallpox remains the only human disease to have been eradicated. This success in 1980 is still portrayed widely as a triumph of cooperation between countries and a demonstration of how biomedicine can unite people. The World Health Assembly provided the forum to agree on a global health goal and the World Health Organization (WHO) had the necessary links with national authorities to coordinate and implement a policy, and to draw on international 'scientific' expertise. Central to the policy's success was seen to be a small network of 'professional' WHO staff who could work with and mobilise the large number of national staff.
Nepal was one of the last small group of countries to eradicate smallpox. Although not high in global priority, a case study of Nepal allows us to explore and challenge this top-down and centre-led narrative of encounter and exchange. Even the official history of the global programme acknowledged that central to the success in Nepal were the district supervisors and the introduction of a special annual vaccination programme that responded to Nepali people's attitudes to vaccination. In a country of enormous communication challenges and very limited infrastructure, the few foreigners had limited effect.

Symposium Unexpected Technology-Based Games (ICOHTEC) - ID 280

Contribution ID: 937
Tourism – a Kind of Playing? A methodological approach

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Doing tourism and playing are in some way similar activities. An example are tourists, breaking conventions during vacations. Sometimes they behave similar to persons, who are celebrating carnival, the famous game of the inverted world. Some activities combine elements of tourism and of playing – for example visiting soccer games. Whereas the traveling fans, who decide to visit a game tend to combine tourism and playing, the local fans only take their chance to play during and after the game. Thinking about the built environment of the stadium, the mobility devices used to visit the place, and the technology, directly linked to the game, it becomes clear that both, playing and tourism are linked to technology.
The aim of the paper is, to analyse similarities of tourism and play systematically. The author will investigate to which extend tourism can be described as a kind of play. Classical methodological approaches towards playing - written by Johan Huizinga, Roger Caillois, and Brian Sutton-Smith - will be applied to analyse tourism. Focus on technology-based playful or touristic activities will be linked to the author's approach to play (Glücksmaschinen 2016). If it is possible to describe tourism as an example of unexpected technology-based playing, this will give a hint, that many activities are suitable to be analysed by tools, developed for scholarly discussion of play.

Contribution ID: 584
PlayXR – prototyping multiplayer mixed reality gaming

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In 2018 we experimented with mixed reality gameplay in the context of an installation at Vienna's Volkstheater called "Vienna – All Tomorrows". This project led to a more technology focused project called PlayXR, which is a framework for playing together in a mixed reality environment with variable technical setups. As we move from hand-held devices to incorporate fully immersive AR glasses, we see a potential drastic change in user interactions and patterns of play that will come with these new technologies.
Curiously enough we have for now only the promises of technology, but still await their arrival. As so often, the marketing hypes surrounding the products' launches often cloud the real potential of these technologies, falsifying their capacities. This can reach from mere exaggeration to outright fraud. This has been a constant in the history of commercial consumer virtual reality technologies since the 1990s, when the first wave of products failed spectacularly in the market after boasting announcements. Right now, we are navigating these treacherous fields, testing and evaluating various available devices. But very often, our development is also speculative, attempting to envision how these promised gifts might actually function, what features might arrive in the end and what is outright impossible and merely exists to cash in on venture capital.
It is these promises though that created the very jolt that also energises our work: the arrival of a new technological paradigm with new means of interactions that will be completely change how we interact and play with each other.

Contribution ID: 882
Neuromorphic Games, from Ramon y Cajal to art and play in public experiments with Brain Computer Interfaces

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Our research objective is the creation of a new form of experimental game art – the neuromatic one – to contribute new knowledge, awareness, and resilience, and to elucidate ethical questions, possibilities and limitations of technologies that intrude the individual brain and to ultimately change self-optimization into self-expression — as it also was at the beginning of EEG studies, since the time of the "invention" of the neuron by Ramon y Cajal in the 19thcentury — were artistic research and art married.
Art and Play currently undergoes a rush of presence and importance in the context of artistic research, as it informs methods of insight and cognitive experiments. Ludic experiments in the Form of Neurogames and the transformative potential of play serve as theoretical frame for a discourse around publicly performed artistic experiments, AI and/or brain data.
Brain interfaces for the consumer market target life improvement but in fact they capitalise our inner states. Neurocontrollers of games are new consumer interfaces to the inner self, if we consider that they unfold as factual neuro-interfaces that evaluate our personal data and general human condition. In the centre of this paper stand very actual critical art works with life science devices and its corresponding participative games, in an emerging critical art form of neuro-games, in a new form of expanded game art. Biometric aspects and neuro-interfaces used in performative installations allow to design a LUDIC experiences, made of elements of behavioural research and a critical questioning of the interfaces used in the art of play.

Contribution ID: 358
Playgrounds—Topographies of Play and Technology

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Playgrounds are probably the most visible form of urban play. They reflect ideologies, technologies, politics and economics—as this is the case for all forms of cultural signs. The very fact that playgrounds are often the first association, when the conceptual pair "play" and "city" is mentioned, already indicates a dominant ideology that sees urban space more or less as the opposite of childish play. In this reading, playgrounds protect children from the dangers of urban space, and conversely, they protect the rationalised functioning of the city from the uncertainties of children's play with space.
This proposed paper is based on the interplay between city and playground, traces the ideological appropriation of the playground, introduces technical innovations that can be found on the playground (e.g. climbing contraptions in form of a spaceship at the Vienna International Horticultural Show, 1964), deals with the eventful history of understanding playground as preparation for the workaday world (e.g. American playground reform movement), and takes a look at artists' interpretation of play. The paper will then present current findings from the research project "Topographies of Play", which is an empirical study of playgrounds in the age of digitisation.
Against the background of different Right to the City movements gaining strength, the paper asks about the current function of playgrounds and their possibilities to acquire urban space with new forms of play (e.g. with new materials or technologies like geocaching). How are these newly acquired spaces then accessible, in terms of the politics of inclusion/exclusion?

Symposium (Part 1/2) They might be giants: lesser power and alternative channel efforts in science diplomacy (Commission on Science, Technology and Diplomacy)- ID 484

Contribution ID: 698

Combining History and International Relations to theorize non-state science diplomacy actors: lessons from H2020 InsSciDE

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This paper discusses bridging disciplinary gaps between International Relations (a sub-discipline of Political Science) and History for developing International Relations theory on non-state actors in science diplomacy. International Relations as a social science discipline must be conscious of "presentism", ignoring historical phenomena and erroneously confusing new concepts with new phenomena.
There can be a tendency in IR to consider non-state actors in international politics as a novel phenomenon in contrast to a constructed state-centric past, to which the question could be asked "what current non-state actors matches the English East India Company in military capability?". History offers a rich material on, for instance, non-state actors for International Relations to discuss and develop concepts and theory on non-state actors.
The H2020 project Inventing a shared Science Diplomacy for Europe (InsSciDE) combines History and Archaeology with International Relations to, among other goals, develop European Science Diplomacy Theory and Strategy. The long history of the phenomenon of science diplomacy and the importance of non-state actors stands out in InsSciDE.
This paper will discuss how International Relations can use historical material to theorize non-state actors in science diplomacy based on InsSciDE historical and archaeological material. InsSciDE instantly makes the long historical legacy of both science diplomacy and non-state actors clear. What is the contribution from this long historical legacy to International Relations afflicted by "presentism"? What does it matter for International Relations theory if there is no "progress" in terms of no-state actors modifying constructed state-centric international politics?

Contribution ID: 783

Competing with giants: the alliance between science and diplomacy for the defense of Portuguese colonial claims in the Congo

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The purpose of this communication is to discuss the strategies that allowed Portugal to retain extensive colonial territories in Southwestern Africa, despite intense competition from European powers. The historiography concerned with the links between scientific expertise and international affairs has traditionally focused on events since World War II, but these links are not restricted to the twentieth century and can be followed in the preceding one. In the late nineteenth century, economic and political

interests coalesced to make the colonization of Africa an appealing undertaking, with technoscientific advances being crucial in this context. Portugal, a small European kingdom of limited financial resources, had enormous colonial ambitions in the lower Congo that were defended in terms of its historical priority in the region, but these claims were under severe attack and risked to be entirely overthrown in light of the capacity of other colonial nations to effectively occupy disputed territories. Thanks to the coordination among various agents that accumulated scientific and diplomatic expertise, Portugal was able to ultimately see its claims recognized in the Southern margin of the last segment of the Congo River and even in a small region in the Northern margin (Cabinda), which ultimately formed an exclave that is still part of the modern-day nation of Angola.

Contribution ID: 962

Instruments in science diplomacy: Seismographs and the Limited Test Ban Treaty

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Two central actors, the USA and the USSR, controlled the negotiations on the Limited (nuclear) Test Ban Treaty in 1963. For both superpowers, a prerequisite for the treaty was the development of a monitoring regime. A key monitoring technology was seismographs, designed to record tremors in the earth, and the technical capabilities of different types of seismographs became subject of intense science diplomacy. While many non-nuclear and small nations already possessed monitoring capabilities in the forms of national networks of seismographs, they were not invited to participate in the technical talks.
In 1961-1964 USA began offering seismographs as diplomatic gifts to nations worldwide, to create a global US-controlled monitoring network. At the same time, USSR was developing their own network of seismic stations. Wanting to compare the two networks nuclear monitoring capabilities, the USSR proposed to exchange a seismograph with one from the USA. To avoid political complication the two superpowers agreed to handle the exchanges as a private agreement between two scientific institutions.
This type of instrument-based diplomacy between scientific institutions gave small, non-nuclear nations like Denmark a tool to engage in nuclear diplomacy. By claiming the same shroud of science, Denmark offered to house both types of seismographs at the Geodetic Institutes seismic stations in Copenhagen. Data from the station would be available for all interested scientific institutions, thereby providing access to monitoring data previously controlled by the two superpowers. Denmark's policy objectives behind the offer was to create the framework for a Comprehensive Test Ban Treaty.

Contribution ID: 741

A disunited front: china's failure to win support for bacteriological warfare allegations in the world federation of scientific workers

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In the summer of 1952, an 'International Scientific Commission' of scientists travelled to China to investigate claims that the American military had utilised bacteriological warfare as part of the conflict over Korea. Involving sympathetic scientists such as Dr. Joseph Needham, the commission was part of efforts to lend credibility to the claims made by the Chinese and North Koreans. The commission wasn't,

however, the only avenue pursued by the Chinese government in looking for support among sympathetic corners of the international scientific community. This paper explores one of those alternative avenues, the World Federation of Scientific Workers, and considers the question of why it was that the PRC's scientific representatives in that organisation were ultimately unsuccessful in their efforts. In doing so, it will elucidate the complexities and fault-lines to be found in such cross-bloc organisations and networks.

Session XVI (Part 3/5) - Medicine

Contribution ID: 1125

A mother's siege: love and knowledge in understanding autism

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An educated mother who had raised three healthy children in post WWII America, Clara Park was little prepared to educate her autistic daughter. She wrote about her struggle to find adequate explanations for her daughter's condition in her 1967 book *The Siege*. During this period, prominent psychiatrists and psychoanalysts blamed cold, unloving mothers for driving their children behind autistic walls. Park was the first mother to challenge in print the view that maternal rejection caused autism. Park's book provided much needed encouragement for mothers with autistic children.
But could a mother love her child and reason about her condition at the same time? In this paper, I examine the history of her book's publication and reception. For many researchers, being a mother prevented her from "objective" judgment. Park argued that parents' experiences could help researchers to "know the child in context." For her, scientific objectivity did not require emotional detachment. Her fight to have a mother's voice recognized as a legitimate source of expertise helps us understand wider views about maternal love during this period and illuminates some aspects of the dichotomy between emotion and cognition that still underlie current views about love and about scientific objectivity.

Contribution ID: 1126

Early experimental-psychological work on deductive reasoning in the light of logical positivism

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I investigate the historical roots of the descriptive and normative dimensions of deductive reasoning in early experimental psychology and logical positivism. Specifically, I trace back intellectual interactions among members of the Vienna Circle and early experimental-psychological studies on deductive reasoning. My focus is on the psychologists Gustav Störring and Johannes Lindworsky who ran the first experiments on logical thinking (Störring, 1908; Lindworsky, 1916). Störring was inspired by the experimental work of the Würzburg School and he was in contact with Moritz Schlick in Zürich. While the impact of Störring's epistemology on Schlick has been investigated by Neuber (2016), I focus on Störring's work on logic (1916) and on his experiments on deductive reasoning (Störring 1908, 1926). I also critically assess Lindworsky's book (1916), which extends Störrings pioneering paper from 1908. Key

questions are: to what extent were Schlick and other logical positivists influenced by experimental psychologists like Störring or Lindworsky? What are the philosophical presuppositions of early experiments on deduction and what was their role in the psychologism debate? Answering these questions fills a research gap in the history of the emergence of scientific psychology as an autonomous discipline distinct from philosophy.

Symposium (7/7) 16th Annual Symposium of the Social History of Military Technology (ICOHTEC) - ID 130

Contribution ID: 362

An age of crisis in space?: science fiction and the future of space warfare

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In a seminal works of science fiction, *The War in the Air,* novelist H.G. Wells envisions a future of aerial warfare. But Wells does more than conjecture about technology. Rather, he explores sweeping ideas that animate nations and individuals. These themes shaped the conduct of future wars just as much as the airpower technology that began proliferating during World War I shortly after Wells wrote his novel.
This paper explores similar intersections between technology and ideas in a different domain, examining various works of science fiction's depictions of space warfare. These works of science fiction have been selected to reflect a range of perspectives and cultural frameworks. U.S. Air Force officers, for example, wrote *Space Wars: The First Six Hours of World War III,* in which they depicted space warfare from a more traditional airpower framework. The reasons for this decision merit interrogation because they offer insights into the cultural tensions within military institutions and how individuals seek to use science fiction as an agent of change.
A work like *Space Wars* will be compared to other science fiction written by civilians to explore differences in insights, and predictions as to what space warfare might look like, always grounded in Wells' approach to thinking about intersections of ideas and technology and the ways these shape warfare.

Contribution ID: 466

The Social History of the GPS: How Precision Navigation and Timing has Transformed Our Lives

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A constellation of 30 GPS satellites in orbit since 1978 transformed daily life. Initiated as a military requirement—and still funded entirely by the US Air Force—GPS has become an international public good, inextricable from the civilian realm for which it is now such a fundamental part. GPS now pervades economic relationships of production, trade, and finance. Secure communications enabled by GPS timing signals impact social media connectivity and political interactions among states (as well as within

them) in terms of legitimacy and authority. The reach of socially-constructed change in perceptions of identity and relationships, both human and virtual have, in turn, changed perceptions of the world itself. The animating question above is addressed first through an analysis of the existing GPS constellation. The paper begins with a brief history of the initial ideas and technology that created the need for the on-orbit constellation, namely the potential of precision navigation and precision timing for dedicated military and conditional civil use. The paper then considers the processes and applications that have enabled the ubiquity of GPS and continue to drive societal transformation. By examining the impact of GPS technology through the lens of social history, both positive and negative implications emerge. GPS empowers individuals but at the same time strips away commonly held ideas of privacy and anonymity. Finally, to understand how GPS has influenced societal development over the past 30 years, this paper will use recent examples to illustrate the far-reaching changes from inception to the near future.

Symposium (Part 2/2) The shaping of differences in the historiography of ancient mathematics - Editing and translating ancient mathematical texts (IASCUD) - ID 547

Contribution ID: 630

Historiography in the making: Humboldt and the mathematicians on ancient mathematical texts

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With the publication in the 1810s of the work of the British Indologists, Edward Strachey (1774-1832) and Henry Thomas Colebrooke (1765-1837), ancient Sanskrit mathematical texts were made available in translation for European readers. In the following decades, these non-Western sources were widely read and debated on the Continent. Not only did Guglielmo Libri and Michel Chasles take them into account in shaping their distinctive views of the history of mathematics, but Colebrooke's scholarship also elicited new work from Friedrich Rosen and Georg Heinrich Ferdinand Nesselmann, thus extending further the scope of the *comparanda*.
By the mid 1840s, the wealth of new material thus accumulated made it pressing to strive for a new synthesis. By adopting a micro-historical approach, I will focus on the correspondence between old Alexander von Humboldt and the mathematicians Carl Gustav Jacob Jacobi and Peter Gustav Lejeune-Dirichlet. As he was preparing the second volume of his monumental *Kosmos* (1845-1862), Humboldt submitted a series of questions to his fellow mathematicians, asking them to characterize the differences between the various traditions of ancient mathematics, Western and non-Western, so as to assess their respective contributions to science. It will be shown how these exchanges provide a prism interestingly diffracting the tensions and perplexities in the scholarship of that time, with Jacobi and Dirichlet instantiating contrasting responses to the challenges posed by the rising concern for a renewed historiography of mathematics.

Contribution ID: 620

Editing the Rhind Mathematical Papyrus

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The Rhind Mathematical Papyrus (RMP) was found in Luxor in 1858, and purchased by the British Museum six years later. It dates from around 1500 BCE and consists of over 80 arithmetical and geometrical problems of types that would probably have been encountered during a scribal career. The discovery of the RMP revolutionised modern knowledge of ancient Egyptian mathematics, which up to this point had been understood only in the vaguest of terms. A comprehensive study of the contents of the papyrus was published by the Egyptologist August Eisenlohr in the 1870s, and for many years any discussion of the RMP simply repeated his findings. By the end of the nineteenth century, however, developments in the understanding of the Egyptian language and hieratic script meant that a new edition was called for; this finally appeared in 1923, edited by the (mathematically trained) Egyptologist T. Eric Peet, who was able to provide a more fully contextualised interpretation of the RMP. A further edition of the papyrus appeared in print at the end of the 1920s, edited by A. B. Chace, and aimed very much more at mathematicians than at Egyptologists. Indeed, in the decades that followed, Chace's edition became the go-to version of the RMP for mathematicians, whilst Peet's was usually favoured by Egyptologists. Starting from comments made by Peet himself, this talk will consider the different approaches of mathematicians and Egyptologists to the RMP, and describe how these have shaped the study of ancient Egyptian mathematics more generally.

Contribution ID: 825

Differences between interpretations using and not using modern mathematical symbols? The "procedure of pile-accumulation" in the Jade Mirror (1303)

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Jade Mirror of the Four Elements (thereafter *Jade Mirror*) attributed to Zhu Shijie (1249 – 1314 CE) is often regarded as "the most advanced mathematical work in China" for mathematical achievements that are recorded in this work. One of them is the problems relating to what today are known as mathematical series. In Chinese mathematical writings, the technical term used for the procedure solving these problems is the "Procedure of Pile-accumulation (*Duoji shu*)". Between the mid-14th century and the mid-17th century, scholars no longer fully understood the complicated mathematical procedures introduced in *Jade Mirror*, and this book was not widely circulated in China. At the beginning of the 19th century, a manuscript of *Jade Mirror* was rediscovered and republished. Many scholars wrote detailed commentaries or procedures of calculation for *Jade Mirror*. In the 20th century, when historians researched this book, they often picked up and interpreted three sections collectively in *Jade Mirror*. Moreover, they began to make connections between these parts using modern mathematical series. This presentation focuses on the different mathematical and analytical approaches used to interpret the sections relating to the "procedure of pile-accumulation", and it will show that using different interpretative tools, from different perspectives, and adopting different forms of commentaries elicited great variations in the interpretation of the same problem. Moreover, by comparing the historiographic practices using modern mathematical symbols and those proceeding without modern mathematical

symbols, this presentation highlights the characteristic features and the limitations of interpreting ancient texts using modern mathematics.

Contribution ID: 847

Van der Waerden's Approach to History of Science. His methods and results in comparison to contemporaries

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When Bartel Leendert van der Waerden (1903-1996) came to Göttingen in 1924 after completing his doctorate in Amsterdam, the conditions there were extremely favourable for studies in the history of mathematics, as is rarely the case today at institutes of mathematics. Richard Courant, Otto Neugebauer and Stefan Cohn-Vossen were at the time involved in publishing Felix Klein's lectures on the development of mathematics in the 19th century. Erich Bessel-Hagen, who later, together with Otto Toeplitz and Oskar Becker, represented the history of science at the Mathematical Institute of the University of Bonn, worked as a private assistant to Klein on the publication of his collected works. Meanwhile, Neugebauer gave ground-breaking lectures on the history of ancient mathematical sciences, which van der Waerden, among others, attended. It is therefore not surprising that van der Waerden also began to engage himself with the history of the exact sciences, which resulted in a total of 7 books and nearly 200 articles in this field during his lifetime. The lecture gives an overview of van der Waerden's work in the history of science. It will characterize his research methods and distinguish them from those of his contemporaries. Van der Waerden's strength lay in the ingenious internal-mathematical interpretation and popularization of the research results, whereas several of his colleagues such as Neugebauer, Walter Burkert, or David Pingree focused more on the accurate edition and source criticism of the texts. This often led to differing results and controversial views, which they extensively discussed in their correspondence.

Symposium (Part 2/2) The role of universities in Soviet science - ID 224

Contribution ID: 290

Science in the Soviet Satellites: East-German Research on an example of the Central Institute for Nutrition

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Science in the East-Germany (German Democratic Republic) was from the very beginning thought to be designed along the same lines as the Soviet science. In 1968-1969 East-German science experienced a so-called „academic reform", which finalized the process of labor division between universities and research institutes of the German Academy of Science at Berlin. The latter was seen as an analog to the Soviet Academy of Science and was primarily responsible for research, whereas Universities remained places of education. The East-German academy itself was radically reformed as well. The new statute of

the Academy released in 1969 presupposed a process of the concentration of research and the occurrence of the uniformly structured "Central Institutes". The role of the Party (Socialist Unity Party of the GDR) and of the Stasi (State Security Service) in the science management significantly increased. The supreme authority of the Party (Oberkompetenz) was specified in the new statute of the Academy. At the same time, "Central Institutes" were expected to cooperate with Universities to provide predictability and sustainability of the scientific cadre (term of those times).
The Central Institute for Nutrition in Potsdam was a typical product of the "academic reform". On an example of this institute, I will explicate the characteristic features of the East-German scientific management with a special emphasis on the role of the Security Service which penetrated even the least expected branches of science. Furthermore, I will specify the role of the Universities in the research cooperation on the example of this institute.

Contribution ID: 334

Genetics in Soviet universities in the "post-Lysenko" epoch

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The period of "Lysenkoism" in the Soviet Union caused considerable damage to biological education. Genetics was declared a pseudoscience, and genetic training was banned. After T. Lysenko's downfall (1964), a personnel training of geneticists was one of the most important elements of the revival of genetics in the USSR. The main role in this process played the leading Soviet universities – Moscow, Leningrad, and Novosibirsk universities. Specifically, the Chair of Genetics and Selection of Leningrad University was taught course of genetics even during the years of "Lysenkoism" and in 1963 was published the first textbook on genetics. Due to the efforts of the head of the chair professor M. Lobashev, a pleiad of young researchers had long foreign pieces of training in the USA and Great Britain laboratories in the 1960s. A strong center of genetic education was founded in Novosibirsk on the base of the young Novosibirsk University (founded in 1959). In 1966 the first group of young geneticists graduated from the university. In the following years, the Novosibirsk University became the main source of personnel for the Institute of Cytology and Genetics of the Siberian branch of the USSR Academy of Sciences, which was one the biggest research center on genetics in the Soviet Union. At the same time in many other Soviet universities and educational institutes, Lysenko's followers retained their positions. The vivid example was a professor of Tomsk University B. Ioganzen, who was a faithful follower of "Lysenkoism" till the end of the 1980s.

Contribution ID: 345

Resuming the exchanges between Soviet and French universities after Stalin's death: the example of the mathematician A.N. Kolmogorov's visit to Nancy and Paris in 1958

Laurent Mazliak
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In 1958, the star of the university of Moscow mathematical department Andrei Nikolayevitch Kolmogorov (1903-1987) came for a long stay invited by the university of Paris. This visit was highly symbolic as it was the first of a Soviet mathematician after Stalin's death and an attempt to resume normal scientific exchanges between France and Soviet Union which had become rather limited since the 1930s. Kolmogorov himself had come to France at the beginning of the 1930s but was unable to obtain a permission to come back after 1934. The talk will try to draw the picture of this exchange and its organization, as well as the scientific and mathematical context of the moment. Kolmogorov's visit coincided with a time of considerable extension of Bourbaki's grip over the French mathematical scene and of a relative shelving of probability - Kolmogorov's major domain of expertise - as a subdomain of mathematics in France. All this resulted in a visit which was not completely peaceful and constituted an original experiment in Kolmogorov's career...

Contribution ID: 851
Soviet university seen from Japanese academia

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In the early 1950s Japanese scientists and engineers visited Soviet Union to observe the system of scientific research and education of the socialist country. For example, Hideomi Tsuge, a brain physiologist and a chief secretary of the Association of Democratic Scientists of Japan visited Moscow and Leningrad in 1953. He visited a number of major scientific research institutes (NIIs) under the USSR Academy of Sciences and universities, first of all, Moscow State University, and exchanged opinions with the bosses of Soviet academia.
Japanese scientists and engineers wrote reports after their visits to Russia. What kind of system of the Soviet scientific organizations did they find as remarkable, compared with Japanese ones? Especially, what different role was there between the NIIs and universities of Russia? Based on Soviet cases, some of them tried to show a new policy regarding universities in Japan when the sweeping reforms were going on in Japanese academia after the World War II. By introducing those discussions in Japan, this talk will provide another viewpoint from the outside to evaluate the role of Soviet universities.

Symposium (Part 2/2) Reading the skies: exploring the intersection of ethnometeorology, folk traditions and meteorology (Commission on the History of Meteorology) - ID 418

Contribution ID: 566
Manchester the rainy city: the emergence, popularisation and persistence of a meteorological myth

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Despite being meteorologically middling, for both total rainfall amounts and the number of wet days per year, the city of Manchester in the north-west of England, is often popularly referred to as the 'Rainy City'. This paper traces the historical roots of this nickname back to the Industrial Revolution, and explores how the name emerged at a time when the huge amount of particulate pollution being emitted by the city's booming industries was directly affecting the amount of moisture being held in the atmosphere.
The paper then traces this meteorological moniker into the early twentieth-century, and charts its widespread popularisation during the second half of the century, while simultaneously Manchester's industrial capacity was in sharp decline. The paper explores the different uses of the myth, from the pejorative tone often adopted by outsiders, to citizen's pride in using the term in connection with the industrial heritage of the region.
Finally, the case study presented is used to reflect on how and why such meteorological folklore exists and continues to persist in modern Britain. Drawing on theoretical work on the cultural history and memory of weather in the UK, the paper highlights the important role of such meteorological shorthand for regional and civic identities.

Contribution ID: 644

Reading the skies: exploring the intersection of ethnometeorology, folk traditions and meteorology

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Modern meteorology in the form of systematic observation and measurement of attributes such as atmospheric pressure, temperature, rainfall etc. were introduced in India during the nineteenth century colonial period. Notwithstanding the long period of familiarization, coastal people in rural India continue to observe weather and tide behavior to practice weather forecast including for tropical cyclone. On one hand their practice actively integrates meteorological offerings into local knowledge and on the other hand it seeks to overcome limitation of this form of scientific knowledge through cultural interpretations and explanations. This paper drawing from qualitative field work conducted in coastal India over last ten years argues; reading of skies and weather is not independent of scientific underpinnings but is not limited to it either, as much more is at stake for people who are at the center of it than those who are formally certified specialist. It shows the similarities and contrasts observed between these two forms of knowledge to delineate their approaches and limitations.

Contribution ID: 1137

Climate at the margins: how consumer demand can exacerbate vulnerabilities to climatic fluctuations

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There are extensive and long-standing debates within literature regarding the extent to which climate change impacts are magnified by emerging vulnerabilities within our societies, and whether nature and society should be separated in discourse and models. These debates often rightfully focus on what are perceived to be the most vulnerable regions and groups. However, in doing so, I argue that emergent vulnerabilities within wealthier consumerist societies have sometimes been overlooked. Taking the post-war UK electricity supply system as a case study, I show how consumer demand for electric space heaters pushed the electricity supply system to the brink of failure, despite internal conflict within the industry regarding the extent to which demand for such products should be encouraged. This system on the brink reciprocally magnified the harsh winters of 1946-47 and 1962-63, both of which made substantial impacts on the British cultural and political landscape. This presentation emphasises the inseparability of UK energy supply and atmosphere, showing how weather information was first used by critics of the mainstream industry to diagnose space heaters as an unacceptable burden on the system, how the mainstream industry later used Meteorological Office forecasts to optimise the delivery of electricity in an attempt to cope with burgeoning domestic space heating demand, and finally how emerging clean air legislation in the UK led consumers to turn to electric space heating with renewed vigour. In the post-war UK electricity industry, we see an integrated atmosphere-energy system exhibit emergent vulnerabilities under the pressures of consumer demand.

Contribution ID: 1147

The application of meteorology by the Republic of China in the development of rural areas, 1912-1949

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History, University of Bristol, Bristol, United Kingdom

This paper explores the driving force for scientific development for non-Western countries through the case study on China's meteorological development in rural areas in the first half of twentieth century. Regarding the Republic of China (1912-1949), the countryside was a crucial region due to its relatively traditional social culture and fundamental role in the agricultural system. With the peasantry being closely connected to mobilisation and nationalism, Chinese politicians and intellectuals realised that if China was to develop into a modern nation state, the village masses needed to be incorporated as part of the new national form of government. Among the different approaches employed in rural development, the meteorological measures were worth studying with its emphasis on expertise. To deal with natural disasters, a multi-level meteorological network was established in Zhejiang Province, mainly serving for coastal villages. Concerning the rural economy's development, particularly how meteorology can be applied to serve the primary sector more effectively, rural companies in the lower reaches of the Yangtze River built their own meteorological station, thereby obtaining weather information. This paper responds to the core question of what kind of model is most conducive to science and development's advancement in non-Western countries. The government's leadership may facilitate scientific advancement, while influential people may also develop science through their personal efforts. Regardless, these two models appear to offer insufficient motivation in a country such as Republican China. Contrastingly, local institutions' ambitions underpinned by economic interests may have had a greater effect on scientific progress.

Symposium (Part 2/5) Art, image, and astronomical knowledge (ICHA/CHAMA) - ID 185

Contribution ID: 652
Star atlas: ancient astronomy in the planetarium

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This paper considers the role of early modern astronomical images in modern astronomical pedagogy by focusing on the work of German art historian Aby Warburg and his collaboration with the Hamburg Planetarium. Beginning in 1924, Warburg began a collection of cosmological images from antiquity to early modernity in an attempt to catalogue what he called the "afterlife" of ancient knowledge. The defining organizational logic of the *Mnemosyne Atlas* was thematic rather than chronological, and his goal was spark resonance between similar types of images, even if they had been produced centuries or even millennia apart. While many scholars have approached the *Atlas* as an art historical project, I argue in this paper that Warburg also intended it to be a practical astronomical project that could serve as a body of evidence for ancient astronomical phenomena for use by contemporary astronomers. Warburg actually attempted to have his *Atlas* displayed at a number of public astronomical institutions, including the Deutsches Museum's astronomy wing in Munich, but only found success with the Hamburg Planetarium.
In this paper, I consider how the images that the Planetarium acquired from Warburg serve as both scientific and artistic artifacts, and contextualize them in the history of modern astronomy in Germany. By examining the interactions between Warburg, the planetarium directors, and contemporary astronomers, I argue that the cosmological images *Atlas* and their role in modern astronomical education offer a way to think about images of astronomical knowledge as simultaneously artistic, historical, and scientific.

Contribution ID: 246
Some thoughts on stellar constellations in rock art

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This presentation focuses on quantitative aspects related to petroglyphs allegedly depicting celestial constellations. By deriving stellar magnitudes from a set of early modern and modern artworks and technical images, we resolve that the following picture ingredients need to be corroborated: the time or era of creation of the artwork, the image scale, the image orientation, the commensurateness of the depicted asterism's geometric form with the one we see today, and its completeness, i.e., a match of the number of stars. An overall numerical alikeness, or similarity of appearance of an asterism and a rock art creation, can never be sufficient evidence for unambiguous attribution or identification.

Contribution ID: 503
Reconstruction of historical constellations

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The traditional constellations have often been re-worked during the centuries and before Ptolemy gave a list of 48 constellations in his fundamental book now called Almagest, the Greek astronomers more or less all deviated from each other. The Greek culture is a huge mixture of many different influences due to the many ethnics Alexander the Great summarized under one government. Astronomy was dominated by influences from Babylon and Egypt but some traces also lead to smaller cultures. This non-straight history makes it difficult to reconstruct historical constellations: We cannot simply draw a Greek hero in Assyrian style to obtain the former version of the picture. On the other hand, drawings of constellations such as celestial globes or temple ceilings are hardly preserved.
Thus, the combination of textual descriptions, modern computations, and ancient paintings and drawings is used for an honest and proper reconstruction of historical constellations.
In this contribution, I will explain my method developed for reconstructing constellations in the original design (or as close as possible). I will focus on the reconstruction of the original Almagest constellations as well as the Babylonian constellations in two timeframes (-1st and -2nd millennium). Similar methods are applied to reconstruct the Far Eastern (Chinese-Japanese-Korean) and any other sky culture.

Contribution ID: 254
The Hellenistic constellations through words and images

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The astronomical poem *Phaenomena* written by Aratus in the 3rd century BCE is the first comprehensive extant written description of the 48 constellations, which remained very popular for many centuries. The oldest known celestial globe comes also from the Hellenistic times and is the so-called Kugel globe that dates from the 3rd/2nd century BCE. In this paper I am comparing the star map of the *Phaenomena* to that of the Kugel globe focusing on the position and the iconography of the constellations. This comparison will help us ascertain the ways the globe and the poem are related and potentially complement each other. The following questions are going to be addressed: Does the Kugel globe follow Aratus' description? Could the images depicted on the globe facilitate the understanding of the astronomical poem and vice versa? Does this object communicate any extra information about the heavens that we do not get from the written source?
By exploring these issues, I aim to reveal the ways people from the Hellenistic times visualized and depicted the constellations.

Session XIX (Part 2/4) - History of Physics

Contribution ID: 1247
The introduction of vacuum tubes by the Imperial Japanese navy, 1914-1918

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This paper aims to explore how the Imperial Japanese Navy attempted to introduce vacuum tube technologies. The vacuum tube, invented in Western countries at the beginning of the 20th century, was a revolutionary technology that made it easy to detect, amplify, and oscillate in wireless communications. In Japan, it was the Ministry of Communication and the Navy that led to the introduction of vacuum tube technologies. However, due to a lack of documentation, little has been known about how the Navy introduced them.
This paper surveys new materials and focuses on the flow of the people, objects, and documents to observe the introduction process in detail. In 1914, the Japanese Navy employed Hayashi Fusakichi (1879-1919) who had studied theoretical and applied electricity at the University of Göttingen from 1909 to 1912 and let him manufacture the 'Lieben tube'. Furthermore, using the expatriate system, the Navy sent major Katsuyuki Nishizaki (1881-1949) to study at Harvard University and attend lectures by G.W. Pierce from 1915 to 1917. While studying in America, Nishizaki sent a report to the Japanese Navy on the method of continuous-wave generation. Also, Yoshitake Ueda (1878-1957), who was stationed in America, sent Western Electric's vacuum tube amplifiers to the Japanese Navy, which were used as a reference for the Navy's weapons development. This study is important for a more accurate understanding of the patterns of the introduction of foreign technology in Electrical Engineering into Japan.

Contribution ID: 1123
Virtual Particles: From Hideki Yukawa to Richard Feynman

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Nowadays, virtual particle concept has become an integral and fundamental part of modern physics, both for quantum electrodynamics and quantum field theory. From the late 1940s, the Feynman diagrams played an important role in disseminating and recognizing a concept that nevertheless still raises many questions, ontological of course, and concerning its own physical meaning. In his time, Richard Feynman's work was distinguished by his temptation to connect the term "virtual" in a much more regular way to quanta and particles, rather than to transitions or processes, as in the work of Julian Schwinger, another reference contribution of the quantum electrodynamics of the time.
This communication sets out to redefine Feynman's historical and conceptual framework by connecting it to developments in the meson theory of nuclear forces. Originally introduced in 1935 by Hideki Yukawa by analogy to developments in quantum electrodynamics, the meson theory is indeed one of the first theories for which the qualifier "virtual" was directly associated with the idea of particle. Above all, it became at the end of the 1940s a central theme of fundamental research in modern physics.
Thus, we will comment on the evolution of the concept of virtuality in meson theory before discussing how the latter played a role in the work of Feynman, one of the giants of quantum electrodynamics.

Contribution ID: 1198
Atomic fish: Sublime and non-sublime nuclear nature imaginaries

Anna Storm
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In this paper, I will articulate a tension between sublime and non-sublime nuclear nature imaginaries through an investigation of four types of atomic fish practices in and around nuclear power plants: fish farms, sports fishing, management of fish in cooling water systems, and finally, test fishing as part of environmental monitoring programs. Nuclear technology is generally understood as exceptional, be it from a utopian or a dystopian point of view. This understanding, combined with the sociotechnical imaginary of containment, forms the basis for an (inherently contradictory) nuclear technological sublime. In contrast to this dominant imaginary, I suggest that there is a partly interrelated, partly parallel, set of nuclear imaginaries characterized by domestication, normality, and the non-sublime, discernible through mundane activities such as atomic fish practices. The existence of fish farming at nuclear power plants, along with sports fishing in the surrounding waters, shapes an understanding of atomic fish as a normal, or even slightly improved human diet, to harvest or to hunt, while the controlling practices of managing and testing fish in cooling water systems and environmental monitoring build an imaginary of normality based on everyday routines. Domesticated nuclear natures therefore signify, on the one hand, a containment of the exceptional aspects and, on the other hand, normalizing practices on the household scale. I conclude that domestication of nuclear natures must not only imply the control and containment of something exceptional or wild in a sublime sense, it can also denote normalization without grandeur.

Symposium (Part 2/3) Interactions and interchanges in the history of science, technology, and medicine - ID 162

Contribution ID: 393

Linnean taxonomy of the New Zealand fauna: From Cook's collections to modern genetics

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James Cook's voyages to the South Pacific were, in part, motivated by a desire for scientific exploration. One of the lasting consequences of Cook's time in New Zealand were the biological collections and, in particular, the Linnean scientific names bestowed on a number of the specimens taken back to Europe. Although the local Māori had been instrumental in much of the collecting, their language was largely ignored in the resultant Linnean nomenclature. Some of this omission was simply because many of the Linnean taxonomists classifying the various plants and animals had never been to New Zealand; they were naming species collected many years before by others. Today, however, Māori are active partners in various taxonomic research projects, contributing and co-authoring scientific names. I first place this transformation in the context of the 19th-century realization of the unique character of the New Zealand biota. I then consider how it fits with more recent international agreements (notably, the Convention on Biological Diversity and the supplementary Nagoya Protocol), as well as claims (especially the so-called "WAI 262" claim) under the Treaty of Waitangi, signed between the British Crown and Māori rangatira (leaders) in 1840.

Contribution ID: 396

Tracing the Artisan in a Philosopher's Practices

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This paper investigates vitrification trials on gold at the courts in Kassel and Paris in the early eighteenth century. The question driving vitrification experiments was whether metals could be analyzed into their fundamental elements under extreme heat and then reconstituted. New convex burning lenses, capable of generating powerful heat, proved a technological advantage in these endeavors. The Saxon mathematician and technologist Count Ehrenfried Walther von Tschirnhaus (1651-1708) from Kieslingswalde gained international fame for constructing them. Two of his enormous burning lenses were used by Wilhelm Homberg (1653-1715) in Paris and by Nicolas Hartsoeker (1656-1725) in Kassel in their respective attempts to vitrify gold. All three men were natural philosophers, technologists, and members of the Paris Academy of Sciences, whose trajectories intersected with the world of craftsmen, German mining, and courtly science. Their experimental reports and personal correspondence reveal the ways in which craft operations and ideas shaped their interpretations of vitrification experiments. In this paper, I examine how they defined, leveraged and appropriated the practical knowledge of German miners and metalworkers in order to test whether vitrification of gold was possible, and how they positioned themselves as brokers of craft and philosophical expertise.

Contribution ID: 798

Missionaries and science in global context

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This paper explores interactions and interchanges between Western Christian missionaries and indigenous go-betweens in the making and spreading of science, technology and medicine (STM) during the long nineteenth century (1789-1914). Although missionaries hoped that spreading STM would benefit Christianity and Western colonial powers, they could rarely determine the course and consequences of these exchanges as decisively as they hoped. Indigenous people shaped the timing, process and outcomes of these interactions in ways that often discomfited and sometimes alarmed the missionaries. Illustrating these claims with examples from India, China, Africa and the Pacific, this paper questions historical narratives that attribute more power to missionaries and their sending cultures than the evidence warrants.

Contribution ID: 926

The making of green gold: An entangled history of medicinal plants introduced to the Philippines in the Age of the Galleons

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In this paper we examine the transfer and transformations of Mesoamerican knowledge into colonial Philippine medical practices for plants introduced during the Philippine-Mexico Spanish Galleon Trade (1565-1815). We address this in three parts. First, using 17th-19th century herbals we discuss the uses for selected plants in Nueva España, and which uses were adapted, accepted, or rejected after the plants' transplantation to the "Spanish East Indies". Second, we consider the trajectory of these plant uses over time in the Philippines within the context of the and their limitations. Who documented these uses- were they authorities in their fields, and what challenges do modern researchers face when assessing the extent to which these works reflected plant uses *en vivo*? We highlight the issues of reinforcing the use of introduced plants with external medical traditions, and of borrowed descriptions from previous works, which risk self-referencing circles of knowledge that perpetuate a record of traditional use not practiced. Third, we compare the food and medicinal uses collected across these historical sources with those of modern communities of the Filipino diaspora, to assess whether the aforementioned limitations are evident in the post-colonial Philippine context.

Symposium (Part 11/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 216

Contribution ID: 1261

The second sense: 19th-century sound experiments in the Czech lands and why they came to be seen as peripheral

Anna Kvicalova
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In the past decade, historians of science and researchers in the field of „sound studies" have paid a sustained attention to historical investigations of sound and hearing at the intersections of the arts, humanities, and sciences in the long 19th century, and introduced an alternative perspective on European modernity, one that stems from the study of hearing and acoustics. While the sonic underpinning of modernity has been strongly associated with the work of German scholars such as Ernst Chladni, Hermann von Helmholtz or the Weber brothers, the research on hearing and acoustics carried out in the context of Czech sciences of the time has not been systematically studied.
The paper shall introduce a broadly defined area of experimental acoustics as it was developed in the Czech sciences on the crossroads of physics and physiology, but also pedagogy, philosophy, phonetics and musicology. The research question is twofold: (a) Why does "sound history" remain a marginal historiographical topic in the study of Czech and, by extension, Central European science? (b) Why did much of the original research on sound and aurality, including hearing experiments with the deaf and the construction of original acoustic instruments by prominent scientists such as Jan Evangelista Purkyně, became peripheral and hardly ever referenced already towards the end of the 19th century?
The presentation will outline several possible reasons for the perceived peripherality of sound research in the period, ranging from the status of auditory knowledge in the sciences and humanities to the language of the works published.

Contribution ID: 1053

A failed object or a failure of an object? The Electrophone in Britain 1893 – 1935

Natasha Kitcher
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The Electrophone was a Victorian telephone device that broadcast live theatre, music performances, science lectures and church services into the home from 1893. It was a streaming service before streaming even existed. However, in 1920 the Electrophone Company closed its doors and this product, which could have signalled the start of technology we know and use today, was lost to the ether.
The Electrophone is a valuable case study because its ideological underpinnings are similar to those of its modern counterparts, notably the smart phone as well as platforms such as National Theatre Live that launched to broadcast theatre to wider audiences. It granted access to infotainment without having to leave the home, and in some recorded cases without having to change out of one's pyjamas. In this way, it seems like a forefather to the tech-giants of the 21st Century. But how much weight do arguments such as this have when the technology is understudied and mostly forgotten by contemporary audiences? Can a "giant" be posthumously declared?
This paper will use the case of the Electrophone and pre-existing literature in the history of science and technology (in particular, *Rewriting the Book of Blots* (Gooday, 2008)) to challenge definitions of technological success and failure. I demonstrate that studying the Electrophone enables us to better understand today's technology and challenge the notion that what is used now is the 'final' or 'best' version of technology by showing that similar objects to today existed in the past and fell out of use.

Contribution ID: 400

Visualization of Astronomical Interfusion: A Geocentric Armillary Sphere in the Qing Dynasty Palace in 1669

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The European geocentric armillary sphere was first introduced to China by Jesuit Matteo Ricci through his world map (1584) upon which he included a drawing and description of the instrument. In 1669, Jesuit Ferdinand Verbiest made an armillary sphere for emperor Kangxi, which is still preserved in the Palace Museum. The instrument can visually demonstrate the structure of the celestial sphere, and the relationship between the heaven and the Earth. It is clearly different from that of traditional European instruments and demonstrates the fusion of Chinese and European astronomical knowledge.
This study attempts to reconstruct the manufacturing and use of the armillary sphere in the Forbidden City, and to retrace the acceptance process from Ricci's "instrument for heaven and Earth"(天地仪) to Verbiest's "armillary sphere"(浑天仪). I will also discuss the changes in the standardization of the geocentric armillary sphere in different spaces, as well as the fusion and re-shaping of the knowledge system demonstrated by this instrument.

Contribution ID: 1154

Horoscopes in the seventeenth-century Ottoman annual astrological predictions: Ḥüseyin Efendi's Aḥkām-ı ṭāliʿ-i sāl ve taḳvīm

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Aḥkām-ı ṭāli'-i sāl ve taḳvīm (judgments for the ascendant of year and almanac) are valuable sources not just because astrological practices and cultural characteristics on health, nutrition, religious and philosophy they describe but also some traces of astronomical, and meteorological knowledge they contain.
This presentation focuses on horoscopes for the 12-year animal cycle calendar and the ascendant of the year for the latitude of Istanbul based on eight *aḥkām*s which were prepared by Hüseyin Efendi (d.1650) who was a significant figure not only for his life but also his astrological prognostications during twenty years of his post as the chief astronomer in the seventeenth century Ottoman Empire. His eight *aḥkām* texts from AH 1049/50 *(1639/40 CE) to* AH 1060/61*(1650/51 CE),* except years between AH 1051/52 *(1641/42 CE)*- AH 1055/56 *(1645/46 CE)* which are kept in the Library of Kandilli Observatory and Earth Research Institute (MS 165/1-8). By analysing of theoretical aspects of these *aḥkām* texts, this presentation attempts to shed light on the background of astronomical principles of horoscopes, the conceptualisation of knowledge among seventeenth-century Ottoman astronomers, to determine the relationship between the *aḥkām* writer and the *aḥkām* user and their place in the historiography of science.
The author gratefully acknowledges that this paper is a part of an underway project entitled *A Comparative Study on Theoretical and Practical Aspects of Scientific Activity in the Ottoman Empire: Annual and Perpetual Calendars (1550-1710)* is funded by the Scientific and Technological Research Council of Turkey (project no:119K827).

Symposium (Part 2/2) They might be giants: lesser power and alternative channel efforts in science diplomacy (Commission on Science, Technology and Diplomacy) - ID 485

Contribution ID: 677
Ukrainian science diplomacy in interwar Central Europe

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Despite intensified nation-building efforts and failed state-building projects during World War I and its immediate aftermath, the Ukrainians remained non-dominant groups in all regions of today's Western Ukraine. Multidisciplinary Ukrainian politicians, most of which were scholars themselves, secured themselves a position as professors at the Ukrainian Free University (UFU) in Prague. It was founded in 1921 and state-funded since then because of successful negotiations with T. G. Masaryk. Alongside several other institutions in Czechoslovakia, it became the core organization of Ukrainians in emigration.
What was considered the generic centre of Ukrainian science outside of the Soviet Union, Polish Lwów (former Lemberg, now L'viv), was threatened by repressive Polish strategies since 1919. The establishment of the UFU highlighted the perspectives of cooperative strategies; they actually led to the foundation of Ukrainian Scientific Institutes in Warsaw (1928/30) and in Berlin (1930).
This paper will analyse concepts and strategies of Ukrainian science diplomacy in Poland, Germany and Berlin. I will argue for the hypothesis that cooperative strategies often led to visibility and support of the Ukrainian project, even if cooperation might have been considered 'unpatriotic' from the perspective of

radical nationalism. The question why most of Ukrainian initiatives left Austria in the early 1920s will serve as a litmus test for the respective observations.

Contribution ID: 775
Building Europe through physics during the Cold War

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The talk discusses the role played in the process of European integration by informal channels and grassroots organizations established by physicists. This approach contrasts with widespread theoretical approaches in the European integration historiography, which have traditionally interpreted the process of European integration as institution building. In the history of science and technology, the institution-building perspective has led to a strong focus on the role of technological infrastructures in shaping modern Europe, where CERN is taken as *the* model of successful European techno-scientific cooperation. By contrast, the role of transnational scientific networks and shared values in the way international scientific cooperation shaped the European integration remains understudied. By focusing on a number of bottom-up physicists' international initiatives not aligned with nation-states' interests, the paper will analyze how physicists tried to implement and actualize the process of European integration at a more informal level. I will argue that these activities became alternative channels of science diplomacy aimed at overcoming the two-bloc Cold War divide.

Contribution ID: 917
They might be giants: lesser power and alternative channel efforts in science diplomacy - Part 2/2

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Vision(s) of War?: Warsaw Pact Civil Defence Cooperation
In December 1965, Marshall Chuikov (Чуйков) explained that the advent of rocket and nuclear warfare, necessitated a replacement of air defence organisations dating back to WW2. Unlike traditional air defence, civil defence --a combination of state and societal measures-- would henceforth protect the population and respond to an immediate attack. However, not all member states agreed on all points and it is the resulting (dis)agreements that this paper focusses on.
In particular this paper examines the inception of Warsaw Pact civil defence cooperation, the underlying politico-military visions informing it and their manifestations in technical-scientific exchanges. Among historical scholarship on civil defence, there is a tendency to conceptualise it as a national endeavour, with too few scholars investigating its internatonal manifestations. Based on German, English and Russian archival documents, this paper takes the first step towards reconceptualising civil defence as an alliance endeavour and an alternative channel for science diplomacy.

Contribution ID: 684
American 'Soft Power' in France, 1801-1851

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In 1847, the chemist Jean-Baptiste Dumas declared that America was ahead of England (and they ahead of France) in the "sciences des machines." All of this happened before the Crystal Palace Exposition of 1851. How did France become aware of America and its knowledge of "mechanical sciences"?
I argue for the importance of American diplomats as a critical channel for introducing knowledge about US inventions, technologies, and agriculture to the Société d'encouragement pour l'industrie nationale, founded in 1801 to advance French industry and innovation. I argue that the diplomats' efforts constituted an example of "soft power," as coined by Joseph S. Nye, Jr. I add to the literature by looking at technical culture in the hands of US diplomats as a form of soft power. I show how a handful of American diplomats assigned to France exercised "soft power" and enhanced the image of American technical culture through their participation in the Société d'encouragement, which had close ties with the French government.
The diplomats all were members of the society; one of them served on a technical committee long after completing his diplomatic duties. These diplomats also were scientists and inventors in their own right. They informed France of such key technological achievements as Fulton's steamboat, the steam engines of Oliver Evans (Philadelphia) and others, a steam-powered printing press (adopted by Firmin Didot, Paris), the cotton gin, and sugar processing machinery. The society even awarded an American one of its prizes, the first foreigner to be so rewarded.

Session XVI (Part 4/5) - Medicine

Contribution ID: 1140

Quarantines in the Russian Empire: Entangled Histories of Medical Knowledge, Diseases and Policy Measures

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Quarantine studies, as an independent historical trend, emerged from the history of epidemics in the last decade. In this regard, my report presents the case of the Russian Empire of the 18th - 19th centuries, which faced a huge number of epidemic outbreaks, leading to the increased attention to the establishment of quarantine. Quarantine measures were supposed not only to protect the territory and population from the penetration of an epidemic disease into the country, but also to meet the political needs of the state. The late 18th - first half of the 19th centuries were a period of pre-microbiological level of development of medical knowledge. Pathogens of epidemic diseases had not yet been discovered and physicians relied on various medical theories, such as contagionism or miasmatism. In such case, quarantines could be a tool for dealing with an unexplored disease and an indicator of the lack of knowledge. However, the responses to different infectious diseases can disprove this theory. At the same time, quarantine was a political tool, protecting the national borders of states and responding to the political agenda of the government. However, quarantine required the existence of a disease to justify the emergence of quarantine measures.

Thus, in my report, I want to investigate the relationship between disease and quarantine. What was the "quarantine discourse" like? How did different types of still-unexplored diseases interact with quarantine measures? Did these interactions lead to the strengthening of international ties or did they contribute to the isolation of states?

Contribution ID: 1202

Establishing Rapport: Gary Fisher's LSD Treatment of Autistic and Schizophrenic Children in the 1960s

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In the 1960s, several psychiatrists in the US investigated whether the hallucinogenic drug LSD could be used to treat autistic and schizophrenic children. Despite growing attention to the medical history of LSD, historians have not explored the use of LSD in child psychiatry in any detail. I focus on the work of the clinical psychologist Gary Fisher who used LSD to treat twelve autistic and schizophrenic children at Fairview State Hospital in California. Fisher's program was unique in that it was the only one to treat children using "psychedelic therapy", a specific form of LSD therapy developed by psychiatrists in Saskatchewan that was based on generating powerful, transformative experiences to break through a patient's defenses. Although the psychedelic method was designed to treat adult alcoholics, Fisher worked to adapt the method to fit the needs of children. Drawing on detailed transcripts of these LSD sessions, I focus on the therapeutic relationships that Fisher and his treatment team developed with the children at Fairview. While the use of hallucinogenic drugs to treat vulnerable children ethically problematic, what comes across in Fisher's records is a compassionate and empathetic relationship between the treatment team and children that was fundamental to but extended beyond the treatment approach. Fisher often fondly noted the jovial and cunning complexity of the children who he thought were improving during their LSD treatment. Fisher's work thus reflects larger themes about the relationships between patients and therapists in mid-20th century attempts to treat childhood disorders.

Contribution ID: 1081

The poliomyelitis in Mexico and its contribution to the progress and consolidation of orthopedics as a medical specialty in Mexico. 1946-1960

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Theme: Orthopedists against the poliomielytis epidemics in Mexico (1946-1960).
The objective: It is to show how polio epidemics contributed to the development and consolidation of orthopedics as a medical specialty in Mexico and to analyze the work of orthopedists during the polio epidemic that hit the Mexican population in the mid-1940s and early 1950s que, in his quest to combat the aftermath of this disease, he invented all kinds of mechanical means and stabilization of the hip and legs (so that the child could be as independent as possible).

Marc theoric: It is a remarkable fact that to this day, there is very little work on the polio epidemics that ravaged the Mexican population of the mid-1940s and early 1950s. References on the general lines that have emerged in this type of research, from the twentieth century to the present day, have been published in specialized journals such *Gaceta Médica de México* and *El Boletín Médico del IMSS* that published in the year 1959, a number dedicated to this disease. In several issues *of El Progreso Médico, Seguridad Social* (1990) *and Seguro Social* (1970), there are pages dedicated to polio. Instead, in publications such as: *El Hospital Infantil de México Federico Gómez. Medio Siglo de Historia*, by Carlos Viesca Treviño and Martha Díaz de Kuri; *Cien años de salud pública en México*. *Historia en imágenes* y *Atlas de la Salud en México* dedicate a space. The thesis, in the university repositories, explains the onset of the disease in Mexico and how it was fought.
Conclusions: In Mexico, neuromuscular conditions such as cerebral palsy and polio contributed to the consolidation of orthopedics as a medical specialty, being in large part the advancement of the techniques used, prosthetics and orthosis, physical therapy, among other factors. The sum of all these elements strengthened the practice and organization of orthopaedicservices to the same time that the century wasadvancing.
Keywords: Poliomyelitis. Orthopaedics. Mexico.

Contribution ID: 1239
Hilary Koprowski - the forgotten winner in the fight against polio

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Hilary Koprowski was a Polish virologist and immunologist active in the United States who demonstrated the world's first effective live polio vaccine in 1950. However, it has long been eclipsed in public memory by the triumphs of Salk, whose injectable vaccine was introduced in 1955, and Sabin, whose oral vaccine was introduced in stages in the early 1960s. The historian David M. Oshinsky writes in his book: "Jonas Salk is a god in America, Albert Sabin's got a ton of publicity, and Hilary Koprowski, who really should be part of that trinity, is the forgotten man." Hilary Koprowski was born in Warsaw to an educated, assimilated Jewish family. He received a medical degree from Warsaw University. In 1939, after Germany's invasion of Poland, Koprowski left the country with his family and settled in United States. At that times he started working on a vaccine against polio, a disease that caused permanent disability and was a huge problem all over the world. He injected the polio virus into cotton rat brains, inside which the virus was gradually weakened (attenuated) and could be used for the production of a vaccine. Dr. Koprowski tested the invention on himself, 2 years later successfully on a group of 20 children. Within 10 years, the vaccine was being used on four continents with huge effects. Despite this it was never approved for use in the United States. In spite of being underestimated, Hilary Koprowski was undoubtedly a giant in medicine.

Symposium (Part 6/6) Transportation History: Vehicles of mobility - feet off the ground (ICOHTEC) - ID 533

Contribution ID: 742

Lifts - A sign of wealth or the technical awareness development of the society?

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Lifts are a necessity in modern architecture. They are already common today. Nevertheless, at the turn of the 19th and 20th centuries, they were luxurious furnishings, symbolising the material wealth of owners. Decorative, openwork elevator shafts have great artistic value. The high standard is also evident in the decorative design of wooden cabins and their interiors.
Currently, the author is collecting materials for a doctoral thesis on conforming the historical lift mechanisms to the contemporary security requirements and regulations. The primary purpose of the research is to compile the chronological typology of technical solutions and specific mechanisms used in historical lifts in Poland. The current paper aims to describe the diversity of technical solutions used in lifting devices over the years, and discuss four research questions:

- Were the elevators, in fact, luxurious goods and a sign of wealth or the technical awareness of the society?
- How did the lift, as a new architectural element, determine spatial organisation and relationships in the new architecture of that time?
- How did the partition period in Poland and the influence of possessive countries affect the development of lifting equipment in individual regions of the country?
- Is it possible to extract, and if so, what are the unique solutions for individual regions of Poland?

Contribution ID: 773

Technical development of air transport in Slovakia in the context of political changes in 20th century

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In the area of Slovakia, the regular air transport had started just after 1918 when Slovakia became part of Czechoslovakia and modern Czech air engineering was put in use. The first air connection Prague-Bratislava was opened by Czechoslovak state airlines in 1923. The state was continuously building new airports in Bratislava, Košice, Piešťany. Czechoslovak airlines primarily used domestic planes made by Aero or Avia company, but also imported planes made by Ford, Douglas, Farman, Savoia-Marchetti and so on, as well. Flight connections of Slovak territory with some other European cities were in use during the 1930s. After the collapse of Czechoslovakia in 1939, the air transport in Slovak state was under the control of the German government and German airline company Lufthansa. Production of J. Mráz factory in Nitra and factory in Trenčín was aimed at transport aircraft. However, under the pressure of Germany, the factory produced mostly military aircraft (types Junkers 87, Ju 87 D-5) during the early 1940s. After the war and during the Cold War, the Czechoslovak air transport depended on Soviet technology. Czechoslovak airlines were using Soviet airplanes Il-12, Il-14, and Il-18, as well as jet aircrafts Il-62, TU-104 and TU-134. The number of airports was growing, and there were seven of them in public use in the 1970s. The most modern airport was located in Bratislava. In the last decades before the fall of communism, aviation technology was lacking behind the level of development made by capitalist countries.

Contribution ID: 739

The Luxury on Wheels: Tourist Trains in the Interbellum Poland

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In interwar Poland, Germany and Italy, as well as in the Scandinavian countries, railways were a subject of special state care. In these countries, the state controlled the railways. In Poland, the railways were a serious asset of the state, where the value of transport in 1927 reached over 50% of the treasury wealth. The interbellum Polish railways earned a leading position in the world. The trend of modernization and democratization of the railways was visible, in which attempts were made to construct rail cars as comfortable as possible. Modernized passenger wagons were an asset of the Polish railways, rewarded with the Gold Medal at the International Exhibition of Art and Technology in Paris in 1937, the Grand Prix award for a tourist train with a bathing car and an entertainment car. In the Interbellum, building from scratch first the Polish railway, then tourism had an economic significance. Its development was connected with the organization of work and leisure time. The realization of free time was focused on social associations, local and state institutions, trade unions and training associations as the Railway Military Training. The development of communication in reborn Poland created opportunities to fulfil the need for recreation and to popularize of tourism, which began to develop fully from the moment the Polish National Railways took over the initiative. The company attracted tourists with comfort and fun in luxurious conditions in the most elite railway carriages in the world offering dancing, skiing, bathing, a restaurant and even a cinema.

Contribution ID: 859

Integrated railway modernization in inter-war Romania financed by international loans

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Romanian went through a period of modernization of railways before WWI. After WWI Romania regained new territories from Russia and Austria-Hungary, and with these provinces Romania as a successor state inherited long railway-lines (7281 kms) and rolling stock. Adding them to the pre-war 4094 kms of railway, inter-war Romania had to integrate and sustain all the 11375 kms long network. Public and freight transport thus raised in quantity. Between 1923-1938, the Romanian Railway Company needed to make investments to develop the network and the quality of services. Romania benefited of an international loan guaranteed by the League of Nations for the reconstruction including the art of work (bridges, viaducts), tunnels, stations. New sections of railway-lines and a central headquarter were planned to be built. The focus was on trans-national commuting: to facilitate transport from Transylvania via Bukowina to Poland, or connecting Romania via Banat to Yugoslavia. Some sections were planned to be renovated, others to be electrified. An original component of the plan was the building of warehouses along the lines, in the neighborhood of main stations, crossroads or ports. The main administrative building of the Romanian Company was built during the same period. My paper presents these development projects in Romania as an effort to modernize the

Romanian network of railway personal and freight transport in convergence with the agricultural and commercial interests of the country, all this being included in the trans-European Public Works program led under the aegis of the League of Nations and the ILO.

Symposium A comprehensive study on Isaac Newton's optical instruments - ID 106

Contribution ID: 575
Newton's prisms in the Whipple Museum

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In any search for Isaac Newton's experimental instruments, Cambridge would seem to be the obvious place to start. Yet the University holds remarkably little material culture that can be definitively linked to the work of the great natural philosopher. The location of Newton's famed glass prisms, in particular, remains an open question, with at least eight examples held in five different institutions across the UK and continental Europe all at one point or another plausibly linked to Newton's optical work. Only two of these eight remain in Cambridge, in the collection of the University's Whipple Museum of the History of Science. Both have intriguing provenance: one, tantalisingly, came to the Whipple Museum from Newton's own college, Trinity. The other, rather curiously, came via the famed Cavendish Laboratory—founded in 1874 yet from the outset a holder of much earlier relics of science. This paper will give the historical background to these two optical instruments, and explore why both have been treated sceptically by historians as only holding "vague traditions of an association with Newton." Important analyses by Cohen, Mills, and Takuwa, in particular, provide a range of evidence that challenge any Newtonian connections to the Whipple's two prisms.

Contribution ID: 446
Newton's prism in the Royal College of Physicians

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The Royal College of Physicians was founded in 1518 and is England's oldest medical college. Since its founding the college has collected rare books, archives and fine art, but also a collection of medical objects, now looked after by the RCP Museum. One of these objects is a glass prism on a wooden stand, with a catalogue entry that claims it belonged to Isaac Newton. Any provenance information about the prism has since been lost, but research is being undertaken to attempt to establish the origin of this prism, and to investigate how it links to other prisms attributed to Newton and to Willem 's Gravesande in other museum collections.

This paper will provide an introduction to the history of the Royal College of Physicians and its collections and will discuss the RCP's prism, including consideration of the likely inaccurate attribution to Newton, links to other historic prisms, and any new information brought to light by the upcoming research.

Contribution ID: 735
's Gravesande's prisms in the Boerhaave Museum

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In Leiden in the 1720s, curiously, a prism setup intended to convincingly demonstrate Newton's optical theory, appended with an exhaustive instruction text, could be bought off-the-shelf. This situation had arisen due to the collaboration of professor Willem Jacob 's Gravesande (1688-1742) with instrument maker Jan van Musschenbroek (1687-1748). 's Gravesande was one of the prime ambassadors of Newtonian physics on the continent. He achieved success by polishing off the sharp metaphysical 'edges' of Newton's natural philosophy, offering a narrative more focused on empiricism, in his physics textbook *Physices Elementa Mathematica* (1720). Importantly, with Van Musschenbroek, he developed a set of didactically sound demonstration instruments with which Newtonian laws of nature could be demonstrated in a stable fashion.
While the commercial availability of a 'Newtonian' prism setup may seem a case in support of Van Musschenbroek's refined craftsmanship, a closer look raises several questions. How did Van Musschenbroek's prisms differ from English or other continental ones? To what extent was their suitability for demonstration dictated by glass characteristics? What visual technology did 's Gravesande deploy? Was the experimental outcome embedded in the setup? These aspects are important as recent research has pinpointed both material and immaterial factors as having influenced the reception of Newton's optical theory on the continent. In my talk I will outline the role and background of Van Musschenbroek's prisms, currently preserved in Rijksmuseum Boerhaave, and point to some peculiarities that set them apart and may be indicative for 's Gravesande's goals.

Contribution ID: 809
's-Gravesande's prisms in the Utrecht University Museum

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In the collection of historic instruments of the University Museum Utrecht are seven 18th century mahogany stands for experiments with prisms. Three are strinkingly similar to those figured in 's-Gravesande 1742, plate 110, figs. 7, 8 and the original stands in the Boerhaave Museum. Several old prisms may be associated with them. Although the similarity is obvious, some questions need to be answered. The maker of 's-Gravesande's instruments was Jan van Musschenbroek. But none of the Utrecht instruments is signed, so we don't know for certain whether he crafted any of these, or else one of his successors. The remaining four stands, two of which based on 's-Gravesande, plate 114, fig. 4, are different in style.
It is also still unknown by whom and when these instruments were purchased. The 's-Gravesande/Van Musschenbroek stands are mentioned for the first time in a catalogue from 1839, with reference to the

plates in his book. In the 18th century records of the collection no further detailed information can be found.
Jan van Musschenbroek's younger brother Petrus was professor in physics, mathematics and astronomy in Utrecht from 1723 until 1740. He studied physics in Leiden, as a student of 's-Gravesande. He purchased a large collection of instruments for the academy, several from his brother's workshop. There are still a few in the collection. In 1732 he intended to buy a couple of sets. So the stands and prisms could pertain to Van Musschenbroek's purchases. However, another 18th century provenance cannot be ruled out.

Symposium Is there a place for software in socialist economy? (ICOHTEC) - ID 266

Contribution ID: 427

"Through play, knowledge": Computer toys and the scientific-technological revolution in the GDR

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From its very inception, East Germany was a country with eyes fixed on the future. Cast as the lesser Germany, the German Democratic Republic foresaw its supremacy in the future, activated by a so-called 'scientific-technological revolution.' As the seventies roared into being, East German party mouthpieces were busy shifting focus away from amorphous concepts of cybernetics to the utopian potential of the computer. By the 1980s, personal computers were the preeminent utopian signifiers of late East German communist rhetoric, shouldering the duel burdens of surpassing the West and bringing about the full potentialities of communism.
To win the Cold War, East Germany needed to both produce computers and train users in their application. Computer production was costly, their political implications carefully managed, and their use restricted to approved academies. Instead, the state-run company PIKO produced computer toys such as the PIKOdat, PIKOtron, and Kybernet to both generate interest in personal computing and foster the skills necessary for a potential career in engineering, summed up in their slogan: "Through Play, Knowledge." This paper examines how these toys were created to fill the gap between rhetorical promise and actual accessibility. With these toys, the state sought to work against its own inaccessibilities in order to push for a technological future at the forefront of computer design. I examine the artifacts themselves, the utopian rhetoric surrounding their popularization, their instruction booklets and packaging, and advertisements. These toys serve as a microcosm of the state's larger project of building a future technological utopia.

Contribution ID: 534

Late socialist "open source" technologies: The case of the Czechoslovak Turbo 2000 loader for Atari home computers

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In 1980s Czechoslovakia, there was neither official hardware or software markets, nor computer magazines. Home computer enthusiasts gathered in amateur clubs and engaged in amateur programming and hardware tinkering. One of the greatest triumphs of local amateurs was the *Turbo 2000* loader, a solution to the problem faced by local users of 8-bit Atari computers, who did not have access to scarce and expensive disk drives and had to use the notoriously slow proprietary Atari tape drive. Invented around 1986 by college student Jiří Richter, the *Turbo 2000* quadrupled loading speed while only requiring a piece of loader software and some soldering on the tape drive. It was soon adopted by the majority of the Czechoslovak *Atari* community (i.e tens of thousands of users), improving the efficiency of the tape-based informal distribution system that was already in place. In this paper, I will argue that the resounding success of the Turbo 2000 standard was due in part to the way in which it was disseminated. The specification, including hardware and software designs, was published in a special issue of a club newsletter and made available for further comments and improvements. Each club could adopt the standard and modify existing tape drives or even sell *Turbo 2000* boards. The paper will investigate the values and community norms of late socialist computer clubs, and the ways in which the dissemination of this technological solution resembles the open source model popularized in the West.

Contribution ID: 870

Narrating computer history through the prism of popular technical knowledge infrastructure: the late Soviet case

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Recent scholarship on computer technologies "on the other side of the Iron Curtain" contributed to the "provincialization" of Western and US accounts of computer history and significantly enriched our understanding on how technologies co-produce communities, imaginations, and politics. However, following the tradition of the discipline, current histories of "socialist" computer technologies are constructed as contributions to the sub-discipline, "computer history", and, therefore, tend to downplay the importance of broader infrastructure of technical knowledge (including popular knowledge) that made the emergence of computer technologies possible. In my paper, I will present late Soviet cases of computer-related entrepreneurial initiatives and analyze them in the context of the late Soviet infrastructure of popular technical knowledge. I argue that the emergence of Soviet computer technologies, computer communities and computer culture is impossible to understand without taking seriously the large-scale infrastructure of popular technical knowledge in the USSR. Using the prism of popular knowledge of technology, I will show how the knowledge from the fields outside of computer technology contributed also to the general knowledge about computers themselves, and how it thus enabled and facilitated the rise of awareness about computers as well as promoted their various uses among entrepreneurs, potential clients, and other citizens.

Contribution ID: 960

The Siren Song of Socialist Silicon: Deriving Lessons for Contemporary Computing from Communist Czechoslovakia

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While the computing environment in the state socialist societies of East Central Europe was typically interpreted by Western observers in the 1970s and 1980s through the lens of backwardness, an in-depth look at the case of Czechoslovakia reveals how computer technologists adapted to, accommodated and resisted the power and priorities of government and large (state-owned) enterprises. In a world where computing platforms and networked technologies incorporating microelectronics (such as the vaunted Internet of Things), habitually embody anti-consumer practice—locked-down, monetized and data-insecure—this paper uses oral interviews, hobbyist publications and periodicals to look back to the late socialist period in Czechoslovakia, seeking to derive lessons in how contemporary user communities might reassert technological privileges and autonomy in the face of "Silicon Valley imperialism."

Symposium Energy and the environment: conflict or compatibility (ICOHTEC) - ID 313

Contribution ID: 313

Acid rain: causes, consequences, remedies, and regulations

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This paper examines four issues crucial to our understanding of acid rain: 1) what are the causes of acid rain 2) what are the consequences of acid rain 3) what are the remedies for reducing acid rain, and 4)) what are the government regulations that control acid rain.
From the 1800s-1950s, industrializing nations such as the United States and Britain did little to control the passage of sulfur dioxide and nitrogen oxides into the atmosphere. In the United States the earliest regulations, Air Pollution Control Act of 1955 and Clean Air Act of 1963, placed no restrictions on sulfur dioxide emissions, the main cause of acid rain, or on nitrogen oxides emissions. The year, 1963, however, marked a turning point in acid rain research.
The investigations of the Likens-Bormann group at Dartmouth and the US Forest Service beginning in the 1960s, and the extensive 1980s-90s studies by the EPA and the Canadian government showed clearly that acid rain affected natural system; human-constructed objects; and humans' health. Their research convinced most scientists that acid rain resulted primarily from human causes, particularly from combustion of fossil fuels by utility companies and from automobile exhaust.
As a result of these studies, scientists developed four successful solutions that have reduced the damaging effects of acid rain on the environment: scrubbers, electrostatic precipitators, lake liming, catalytic converters, and alternative energies.
The US Congress beginning in 1980 passed additional regulations on 1990 and 2005 to deal with the acid rain problem.

Contribution ID: 685

Energy transition in 20th & 21st centuries: challenges and environmental impact

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The main objective of the paper is to make a systematic and historic analysis of the energy transition process that countries across the globe are undertaking in the race against climate change.
The years 1970-1990 are characterized by a strong technological development and, at the same time, by increasing the danger of destroying the ecological balance. It has been proven that the accumulation of goods and services is not sufficient to achieve human well-being. New concepts and models of socio-economic development have been proposed.
In terms of energy challenges, during this period a large variety of energy-consuming activities was developed. But many of methods of energy production and use have proved to be unsustainable, leading by depleting terrestrial resources, and by disrupting the climate. The number of users and the amount of energy used are constantly increasing. As a result, more efficient means are needed to meet the energy demand.
The years 2000-2020 are the years when the useful energy structure of the Earth begins to be changed. The motto Energy safer, smarter, greener begins to be promoted by the countries of the world.
The paper analyzes the main features of the transition period to an environmentally sustainable energy. The advantages, disadvantages and trends until 2050 for energy transition are given. There is proposed a comparative study for energy transition state of art in European countries, to achieve the successful energy system by clean energy production, and increase the efficiency of the use of energy, specially the electricity.

Contribution ID: 714

Climate change science - a paradigm and its opponents

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The Americal philosopher of science Thomas Kuhn is famous for having described the development of science as a succession of paradigms, where defenders of a ruling paradigm tend to ignore or deny facts and arguments raised against it. Eventually the paradigm breaks, and a new one takes its place. Would it be possible to see climate change science in this light?
There the Intergovernmental Panel on Climate Change (IPCC) represents the established scientific paradigm, also called normal science by Kuhn. At the same time a minority of scientists claim the IPCC science to be ill-founded and too alarmist in character. To prove it they have formed the NIPCC (Nongovernmental International Panel on Climate Change), which has published some reports attacking the ruling view. Is the physics behind that view and its predictions so solidly founded that it cannot be shaken?
Some of the most persuasive arguments raised against the IPCC will be presented, and it will be discussed how the IPCC position with regard to those arguments has developed from the roots of

modern climate history. The role of the ocean as a carbon sink will be given special attention as will the contributions of the first chairperson of IPCC, the Swede Bert Bolin.

Symposium Astronomical Handbooks, Tables, and Education in Islamic Societies - ID 669

Contribution ID: 794

Fazārī's Role in the Formation of the Genre of the Arabic Zījes

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Some biographical sources, such as Ibn Qiftī's *Ta'rīkh al-ḥukamā'*, related that an Indian scholar came to the court of the second Abbasid caliph al-Manṣūr and transmitted an astronomical book called *Sindhind*, and al-Manṣūr ordered Fazārī, a court astrologer, to convert its contents into Arabic, and then Fazārī composed several zījes based on the *Sindhind*. When we review the history of the zījes in the Islamicate world, we realize that there were Fazārī's zījes at the beginning of the creation of the Arabic zījes, so that his zījes are very important when we trace the history of zījes; however, because of scanty documents on Fazārī's zījes, we do not have a clear idea what his zijes are; namely, we have a question: Did Fazārī just copied an Indian astronomical book in his zījes or put some innovation to them?
As for Fazārī's innovation, we find a precious testimony in Hāshimī's *Kitāb fī ʿilal al-zījāt*, where he pointed out that Fazārī was the first scholar who introduced sexagesimal notation to the numbers of planetary cycles in order to reduce calculation tasks. In this paper, with recourse to a re-examination of Hāshimī's statement, I will reveal the importance of Fazārī's introduction of sexagesimal notation to astronomical calculations and clarify his role in the formation of the Arabic zījes.

Contribution ID: 831

Zij Yamini, a newly found Persian astronomical handbook from early 12th century

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A major part of the astronomical heritage of the Islamic civilization is the standard category of astronomical treatises containg numerical tables with descriptions for using them. These treatises were named "zij". Around 200 Arabic and Persian zijes from the Islamic civilization (9th-17th centuries) are known to us and around 100 of them are extant. However, time to time, new zijes appear and in some cases they shed new light on the whole image of the zij tradition. In this paper a newly found zij titled "zij Yamini" will be introduced. I will mention its extant manuscripts, its contents and its scientific and historical importance. Zij Yamini is the second oldest Persian zij which has come down to us, and the oldest Persian zij which has survived in its entirety. It contains important information about the history of the Ghaznavid dynasty of Iran (r. 976-1186). It was composed in Ghazna (present Afghanistan) in 1117, and the two extant manuscripts are copied in 1512 and 1579, respectively. I am preparing a

critical edition of this work jointly with a young colleague and I hope to bring copies of the published edition with me to the Congress.

Contribution ID: 886

Students as agents in the development of ʿAlī al-Qūshjī's al-Risāla al-Fatḥiyya: Astronomy education in Ottoman Constantinople

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This paper aims to explore the close relationship between the compilation and study of a scientific text in the post-classical Islamic period. By stressing how ʿAlī al-Qūshjī's (d. 879/1474) *al-Risāla al-Fatḥiyya*, a work on theoretical astronomy (*ʿilm al-hayʾa*) written under Ottoman patronage and dedicated to Sultan Meḥmed II (d. 886/1481), and his in-class discussions with his students while teaching it, are interrelated, I will demonstrate that students were no less significant agents in the formation and development of scientific textbooks in the late fifteenth century. To be more precise, my paper will first remark that Qūshjī revised his *Fatḥiyya* until his death in Ottoman Constantinople, thanks to which I established its three versions in my critical edition of it. Then, I will provide examples that some of Qūshjī's revisions were shaped by the feedback he received from his students including Ghulām Sīnān (d. 912/1506). Particularly, Ghulām Sinān's account regarding his discussions with Qūshjī is quite important not only because it gives us the opportunity to trace some of Qūshjī's revisions on the *Fatḥiyya*, but also because it offers more evidence regarding pedagogical and scientific contents of pre-modern astronomy education in Islamic context, than the one provided by Fatḥ Allāh al-Shirwānī (d. 891/1486) who relates, in his *Sharḥ al-Tadhkira*, his in-class observations in Samarqand in which prominent members of the Samarqand Observatory and Madrasa including Ulugh Beg (d. 853/1449), the then ruler of Transoxiana, were involved.

Contribution ID: 1293

Explanation Necessary: ʻAlī Qushjī's Commentary on the Zīj of Ulugh Beg

Robert Morrison
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The fifteenth century observatory in Samarqand, founded in 1420 under the direction of Ulugh Beg (d. 1449), attracted luminaries such as Ghiyāth al-Dīn Jamshīd al-Kāshī (d. 1429) and ʻAlī al-Qūshjī (d. 1474). Kāshī, then Qāḍī Zādah al-Rūmī (d. after 1440), and, finally, Qushjī directed the observational program. One of the most important products of the observatory was a zīj (an astronomical handbook with tables) entitled Zīj-i Ulugh Beg (The Zīj of Ulugh Beg). Manuscript copies of the zīj proliferated, and Qushjī went on to be the most important astronomer at the court of Sultan Mehmed the Conqueror (d. 1481).
Because the zīj's instructions for using the tables were brief, there was room for commentaries. This presentation will study the commentary on the zīj written by Qushjī himself to learn more about the practice of mathematical astronomy at Samarqand and in the Ottoman Empire in the fifteenth century. The presentation will focus on the commentary's methods for various astrological computations, the

determination of lunar crescent visibility, the determination of the direction of prayer (qibla), and the prediction of eclipses.

Symposium (Part 3/5) Art, image, and astronomical knowledge (ICHA/CHAMA) - ID 187

Contribution ID: 497

Well then, who dug 'them' canals on Mars?

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By the mid-19th Century the planet Mars was the last planet in the solar system thought to support life beyond Earth. It's similarity to earth, its seasonal changes, its place in the solar system, and the debate over the origin of its curious surface features, has made it the subject of much attention in popular culture and in science. The most controversial aspect of this attention began with the claim in the 1870s that there were canal-like features, which sparked a debate over their existence, character, and purpose. The key element was the question: was there liquid water on Mars? As a Martha's Vineyard *Herald* writer asked in August 1894, after astronomers at Lick Observatory could not find spectral evidence of water, "Well then, who dug 'them' canals on Mars?" Here I will review, from the extant historical and popular literature, as well as primary documentation, both how astronomers presented their evidence, and the ensuing debates among astronomers over the veracity of that evidence their pictorial conclusions drawn through the late 19th and 20th centuries.

Contribution ID: 509

Re-discussion about the two celestial images unearth in Nara, Japan

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In the latter period of the 20th century, two tombs dated at the early 8th century (the Tang Dynasty in China) were unearthed in Nara, the ancient capital of Japan. They are "Takamatsu Tomb" and "Kitora Tomb". Although there are many damages, parts of the murals can still be recognized today. The ceiling of the Takamatsu Tomb is decorated by the 28 mansions, and the Kitora Tomb's is decorated by more than 60 constellations. Although there are many relevant researches about these images, there are few results integrating art history, archaeology and history of astronomy.
This study tries to investigate the reasons of drawing, the process and the significance in the history of astronomy. It believes: the idea of drawing these images in Japan was learned from China, the Tang Dynasty. The prototype of the two images were different: one was from the tradition of tomb art, and the other may be from the scientific sky map in the palace collection , which was brought back by "Kentoshi"(the ambassadors dispatched to Tang). As for the problems such like the time and location

of observation that have confused modern researchers, it can be explained by the traditions of mural paintings and the lack of astronomical knowledge of the painters.

Contribution ID: 291

Art and astronomical knowledge at Dendera in the 1st century BCE

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Astronomical artworks on ceilings in the Egyptian temple of Hathor at Dendera occur in two places: the vibrantly coloured hypostyle ceiling named 'Zodiac E' by Neugebauer & Parker (1969), and the more widely known round 'Dendera Zodiac' ('Zodiac B') sandstone monument, now in the Louvre. The twelve classical zodiac constellations are easily identified, but many figures, derived from Egyptian cosmology, pose a challenge in identification. In their critical overview and claiming to have identified 90% of the astronomical images, Lull & Belmonte (2008) considered the creators of the circular zodiac to have suffered from *horror vacui,* who filled the gaps with carelessly translocated or duplicated constellations.
The author prefers an alternative view towards the identification and placement of the constellations, and identifies the Egyptian versions of the constellations, distinct from the conventional forms widely known in the Greek world. Dendera's datable zodiacs were commissioned during the reigns of the last of the Ptolemies, at a time when Hipparchus and Hyginus flourished. Their works, particularly those listing the known constellations in the Greek canon, and identifying the vernal equinox, are shown to have been influential in the design and layout of the circular Dendera zodiac and its invisible colures. However, Egyptian astronomy art was ever evolving. The temple priest astronomy artists introduced Coma Berenices and styled Lupus, Centaurus and Andromeda to portray political events occurring between 245 – 30 BCE, creating a unique Egyptian astronomy.

Symposium (Part 3/3) Interactions and interchanges in the history of science, technology, and medicine - ID 163

Contribution ID: 587

Paper chains: nature, commerce, and mediation in archives in the Dutch East Indies

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Throughout the eighteenth century, Dutch East India Company administrators dug deep into their own provincial archive in Batavia to unearth bundles of natural-historical papers written almost a century earlier. While natural expeditions were some of the main sources of information gathering in the Dutch East Indies, this presentation focuses particularly on the importance of archives, administrative genres of writing, and systems of information retrieval to demonstrate how administrators recycled past natural-historical information for their present use. I argue that administrators and clerks stationed in Batavia and Ambon were steeped in a scribal culture of their own, one which they had developed into a well-honed system of information collection and retrieval over the course of the eighteenth century. They

read various genres of past administrative writing, from letters and reports to select marginalia and Company resolutions, and based on their reading, wrote new reports with recommendations for how to proceed from their present dilemmas to what they believed would be a better future. They became producers and reproducers of information which fed an ever-growing paper bureaucracy, lending ballast to a Company that, by the last half of the eighteenth century, witnessed growing inter-imperial competition and a severe economic downturn with far-reaching consequences across the Indian Ocean. This presentation attempts to demonstrate the history of the VOC's own practices of retrieving and recycling natural-historical information while also reflecting on the power of provincial archives for historical actors whose own prognostications were based on fragments of mediated information from a different time.

Contribution ID: 700

From hooker to cockayne, new zealand floras and handbooks, 1853-1934

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In 1910, the New Zealand botanist Leonard Cockayne wrote *New Zealand Plants and Their Story* with the ambition to generate interest and enthusiasm for botany in New Zealand; a goal he shared with many of his contemporaries. Indeed, as many as six decades earlier, British botanist Joseph Dalton Hooker had written *Flora Novæ Zelandiæ* (1853; 1855) with the intention to both provide an inventory of the New Zealand flora and its uses, reflecting Victorian science, as well as educate the population on the subject of botany. From the time Hooker compiled *Flora Novae Zelandiae*, to Cockayne's death in 1934, numerous publications on botany appeared, each seeking to promote the science and its joys to the public. However, whilst sharing the same overarching theme, the floras and handbooks differed greatly in their layout, employment of scientific language, and even the value they attributed to botany. In this paper, I examine floras and handbooks, including gardening books, as channels of science communication, highlighting different aspects of scientific pedagogy. On a larger scale, the paper also explores the role floras and handbooks played in contributing to a New Zealand national identity as well as gender and scientific hip.

Contribution ID: 918

Global trade in human organs: historical perspectives

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One of the most significant surgical interventions of the 20th century is the transplantation of organs, cells, nerves, and bones from one individual into another. One of the pressing needs for the success of such interventions is source material. From the start, offering financial compensation to obtain these scarce materials has been undertaken, and has simultaneously excited concern about "traffic in human organs." This paper examines the ways in which different nations have approached the commodification of human body parts, and the challenges that globalization has posed for a "black market" in this vital material. The paper considers the efforts of transplant surgeons and governments to regulate the

market to sure the quality of organic material and to limit the exploitation of the vulnerable providers of kidneys and other tissues.

Contribution ID: 826

From ethnoscience to ethnology - & back again: plant nomenclature, translation and territoriality in Aotearoa NZ

Geoff Bil
History, University of Delaware, Newark, United States

European botanical explorations in eighteenth- and nineteenth-century Aotearoa relied extensively on indigenous expertise, assistance, and terminologies of reference. From the mid-nineteenth-century forward, however, commentators geographically or culturally removed from these relationships began to downplay the botanical value of Māori plant names and knowledge (mātauranga) in favor of their utility for ethnology. In the 1890s, this perspective took root in the work of anthropologists Percy Smith and Elsdon Best, who possessed considerable facility in te reo Māori and were generally sympathetic to Māori culture, but who relied on settler botanists for authoritative plant determinations. This division of labor enabled Smith and Best to draw on the botanical expertise of their Māori mentors - Hone Paraone Tunuiarangi of Ngati Kahungunu in Smith's case, Tutakangahau of Ngāi Tūhoe in Best's - and simultaneously denigrate this knowledge as primitive. I conclude by discussing how this history informs the recent Treaty of Waitangi Tribunal claim *Ko Aotearoa Tēnei* (2011), which takes particular issue with the alienation of Māori intellectual property. This Māori perspective, I argue, hints at the expropriative logic at work in excluding "traditional" communities with ties to local land and knowledge from the process and profits of "modern" science, and points to the constructed and contested nature of received ways of classifying cultures and ways of knowing in a still-unfolding colonial context.

Symposium (Part 12/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 217

Contribution ID: 674

The jewishness of jewish artefacts—jewish mathematical instruments and their medieval and contemporary narratives

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In December 2019, a medieval *quadrans novus* from the collection of Nico and Nanni Israel was auctioned at Christie's. According to its description in the catalogue available online, it is an instrument made in Southern France between 1291 and 1310. This period and this geographical area coincide with the final years and the whereabouts of Jacob ben Makhir ibn Tibbon, an astronomer and a translator of several scientific works from Arabic into Hebrew (1236 Marseilles–1304 Montpellier). He was also the inventor of the *quadrans novus* called in medieval sources *the quadrant of Israel*, a specifically Jewish contribution to the history of science and the history of instruments. Taking this quadrant as a starting

point, I intend to reflect on the Jewishness of this specific object, its relationship with Ben Makhir's invention, and the Jewishness of other similar medieval Jewish instruments according to medieval textual and material sources and contemporary scholarship.

Contribution ID: 361

Religion as a driving force for science: the knowledge of timekeeping

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Islam is a religion that involves with its believers' lives via obligatory practices such as daily prayers or social and economic rules such as inheritance and alms (*zakāt*). The Holy Book of Islam, the Quran, provides the principles of these practices and rules like periods of each prayers and the division of inheritance. In the 7th-8th centuries, Muslims were making rather approximate calculations on these issues. Although the Quran allows some flexibility, it also praises accuracy and precision. Upon the reception of mathematical sciences in the 9th century, an immense rush of learning, adapting, and advancing began. The mathematical approach opened the gates for a pursuit of perfection which was not just for accuracy but also user-friendliness, dissemination of information among societies, and innovativeness. The knowledge of timekeeping is an important source in understanding the relationship between the religious practices and the applications of mathematical sciences. It mainly deals with preparing prayer time tables and constructing and using instruments without having extensive knowledge in astronomy. The scientific knowledge allowed Muslims to indulge their desire for precision and accuracy but the demands of these religious practices and praising of improvement in the Islamic tradition became two of the main reasons for a scientific endeavour that may not necessarily have been this intense in the 9th-15th centuries. The aim of this talk is to provide a brief overview of the development of knowledge of timekeeping and to discuss the role of Islam as a driving force for scientific activities.

Contribution ID: 605

Toward diverse global histories of science and technology: new strategies for displaying and interpreting Islamic instruments for wider audiences

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On display in the National Museum of Scotland are two important Islamic objects that are both science and art: an eleventh-century astrolabe made in Córdoba, in present-day Spain, and a seventeenth-century celestial globe made in Lahore, in today's Pakistan. The astrolabe, made in 1026/27, was long celebrated as the earliest signed and dated instrument from the Islamic West. The celestial globe, made in the imperial Mughal capital Lahore in 1663, is significant for the innovative and demanding technique of its facture. Moreover, scholars have good information about the makers of both objects, which is unusual for works of Islamic art and visual culture. The astrolabe's maker, Muhammad ibn al-Saffar, was an intellectual of medieval Islamic Iberia, while the celestial globe's maker, Diya al-Din Muhammad, was a key member of a prominent family of instrument makers active over four generations from the sixteenth century, and with ties to the Mughal imperial court. Despite the astrolabe and globe's origins at

opposite ends of a geographic and chronological spectrum, together they illuminate important connections between science and art, craft and intellect, operative in Islamic societies in the past. This paper considers the astrolabe and globe in tandem, and proposes that close attention to specific formal and material aspects of these two instruments suggests new strategies for displaying and interpreting Islamic instruments for wider audiences interested in diverse global histories of science and technology.

Contribution ID: 395

Jesuit Observatories and Jesuit Science

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The Jesuit order of the Catholic Church was founded in the middle of the 16th century by a group of men who all had advanced degrees from the University of Paris and who were to open schools around the world that, unusually for their time, included instruction in mathematics and natural history, based on a philosophy of "finding God in all things" including the created universe. These schools soon became centers for scientific research not only within Europe but especially in Asia and the Americas. Many factors contributed to the unique nature of Jesuit science: a wide-ranging eduction including training in communication skills as well as the sciences; access to international travel and intimate contact with indigenous peoples; a network of letters and publications for the dissemination of knowledge; and perhaps most importantly, a motivation to do science not for personal glory or gain but for "the greater glory of God." This shaped not only the questions they addressed, but also the tools they constructed to address those questions. Versed in both theoretical and practical sciences, they often established observatories and invented or improved scientific instruments to explore natural laws, collect data, and render public services. The talk will illustrate how this scientific activity has been - and still is - part of their heritage and their mission.

Session XXII - History of Teaching

Contribution ID: 1079

Uses of history of science and technology in british secondary physics textbooks from the 1870s to the present

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Far from being a novelty of contemporary times, the pedagogical use of historical elements in secondary british physics textbooks has always been a widespread practice throughout the last 150 years. However, that doesn't mean they appear uniformly or that they fulfill the same roles in different sections of the books, nor that whatever patterns one could identify in early textbooks did not evolve over time, following developments both in physics itself and in science teaching, teachers' formation, entrance exams, publishing practices and technologies, and other external pressures. A selection of the most relevant physics textbooks of the period was then scrutinised and each mention of a historical information in them analysed. Four broad categories of pedagogical roles were identified for these historical elements in the texts: (a) characterisation; (b) contextualization; (c) quantification; and (d) ballasting (or internal contextualization). They were analysed in terms of how frequently they appear in the text, and how relevant they seem to be in each particular section where they could be found; or also

what roles tend to appear more frequently in different sections of the textbooks pertaining to different themes (e.g. optics, mechanics, electromagnetism); or still if tend to use historical elements more frequently in sections relating to topics more recently incorporated to the syllabus than in sections bringing more well established, more traditional content, or if in the former case specific categories and roles tend to be more common than in the latter. Quantitative results and their interpretation are shown and discussed.

Contribution ID: 1230

Creative transductive strategies to reduce the gaps: socio-economic inequality in the history and philosophy of primary education in Argentina

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Socioeconomic inequalities, in addition to representing the existing gap between the income of those who consider themselves rich or poor, clearly reflect how the history and philosophy of education used these conditions as tools for change. The school, from its origin, ideally has the social function of reducing this gap, forming autonomous, critical and free citizens, and building equality. Although the budget and the system continue expanding, the COVID-19 pandemic has shown how far it is from meeting the equality goal (Dreesen et al. 2020). It is especially in developing countries, like Argentina, that the disadvantages of an unequal system, which limited opportunities, can be seen most clearly and strongly.
However, one way to reduce unfair situations is to stimulate creative strategies from the primary level, questioning Argentine curricular organization. The transductive theory of creativity (Visokolskis 2016, 2020) is then presented as a response to propose margins of action based on the notion of "interthematic fluidity" (IF) (Visokolskis, Dalio & Carrión 2020), a cognitive category proper to interdisciplinary studies. IF occurs, in the context of creative analogical transfers of ideas, based on a similarity from both domains. It is intended to show how interdisciplinary bridges are built by applying the aforementioned creativity model, appealing for this to an example taken from the history of medicine and its connection with mathematics. The key, in this matter, is trying to explain how the resulting resemblance is the trigger element of interthematic fluidity, providing solutions to the gap of an unequal education.

Contribution ID: 1219

History of scientists and men, between teaching and the history of science

Matteo Torre
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In the school year 2019-2020, during the Covid-19 pandemic, with a 4° Liceo Scientifico class I tried to deal with the complex answer to the question: what are the criteria for the size of a scientific figure?
To address this issue we discussed the Volta-Galvani dispute, which many school textbooks remember only because it led to the birth of the pile. With the students, I analyzed the historical aspects of this scientific dispute, got to know the lives of two scientists and understood that in science there are not

only winners and losers, but men who contribute to the progress of society. Above all, the students have understood that wrong scientific theories do not always exist, but often minority ones lead to new fields of research.
The educational path was tackled remotely, since they were in lockdown, but this did not have repercussions on the laboratory aspect, as some students were able to create various types of batteries with poor materials and to recreate the experimental conditions put in place by the same Alessandro Volta.

Symposium Amateurs and vocational scientists: places of encounters, networks and scientific practices - ID 559

Contribution ID: 614

The pilot's house and the local pilots's collaboration in the scientific-naval expeditions in the Patagonian coast

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This paper examines a particular node of encounter and circulation of information during the first half of the 19th century: the "pilot's house" at the mouth of the Río Negro, in Patagonia. From that place, the pilots watched over the navigation in the area and facilitated the entrance to the port of Carmen de Patagones, the southernmost town of the South American Atlantic coast at that time. Expert captains of the Patagonian navigation offered their services as pilots to merchant ships and naval expeditions. They also got engage in corsair activities, coastal trade and seal hunting. They provided reports and assisted in hydrographic surveys and they took the opportunity to copy maps and talk about the things of nature. In 1832, Captain Robert Fitz-Roy hired the services of two of these English pilots and their boats to carry out the hydrographic survey of the Patagonian coast along with officers of the HSM *Beagle*. The following year, Darwin stayed at the pilots' house and talked to them about these works. This paper argues that the sites such as the Pilot's house in Patagonia operated as places of sociability and information exchange among seafarers, travellers and residents.

Contribution ID: 740

The messengers of science from paso de Cortés: measurements and experiments in high altitude mountains in Mexico, 19th century

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In today's world, laboratories are conceived as spaces reserved for experts, inaccessible to the inexpert, but this has not always been the case. In this paper, I seek to demonstrate how laboratories, the uses of precision instruments and their production, occupy other spaces and establish relations with subjects

and objects foreign to the enterprises themselves. While producing knowledge and objects (vaccines, active ingredients, tissues) experimentalists interact with amateurs, peasants and travellers. Scientific practices, then, are produced outside the chambers of experimentation. To illustrate this, I discuss the various experiences and measurements conducted in a mountain refuge located in Paso de Cortés (3,400 m.a.s.l.) between the two great volcanoes of Mexico's high central plain, Popocatepétl and *Iztaccíhuatl*. From Von Humboldt's visit to New Spain (1803) to medical research in the late 19th century on high altitude respiration, this space summoned experts, indigenous peasants and the nature of the mountain itself to create barometric and thermometric measurements and, later, measurements of respiratory capacity and the number of red blood cells, as well as the cardiac resistance of animals, individuals both sick and healthy, and Mestizos and Indigenous. Laboratory instruments were installed in Paso de Cortés, the site where Hernán Cortés planned his Conquest of Tenochtitlan. The measurements and experiences produced there would later be transformed in the laboratories of the School of Medicine into legitimate evidence for a debate involving European theories about the respiratory capacity of the Indigenous and Mestizos at high altitude

Contribution ID: 866

The Salvador collection in Barcelona at the beginning of the 19th century: between the "curious public" and the "positive science"

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During the initial decades of the 19th century, the cabinet of curiosities that the Salvador family had maintained in Barcelona since the beginning of the 17th century underwent a significant transformation. In the hands of José Salvador y Soler (1804-1855), a lawyer turned agronomist and horticultural businessman, it opened to the visiting public turned into "Salvador Museum" and it was the stage, along with the experimental horticulture gardens launched by Salvador himself, of the meetings between academic naturalists and amateurs, as well as between these and the potential clients of the fruit business of the Catalan businessman.

Contribution ID: 976

Archaeology at the Hotel, Paleontology at the Café: scientific encounters in unexpected places

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Through several case studies (the megalith site of Carnac, the collection of fossil bones from the Argentine Pampas), this paper will focus on the central role of unexpected locations in the development of archaeology and paleontology in the 19th Century. Hotels in France, cafes in Buenos Aires, a "chacra" in Uruguay, these facilities not only provided accommodation for traveling naturalists, tourists and passing archaeologists, but also displayed collections gathered by local collectors and/or their owners. These owners sometimes turned into experts, and became locally or globally renowned. In villages and small towns far from scholarly institutions (universities and learned societies), sometimes in larger cities

outside the Western world, these locations were a central place for encounters between various actors, for the fabrication of science, the circulation of information and the sharing of know-how.

Session XXIII (Part 1/2) - Science Theory and Praxis

Contribution ID: 1280

Confucian scholars' attempts to complement the Chinese scientific tradition with western science

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The China Jesuits found the widespread belief by the Confucian scholars in the "Central Splendor (*zhonghua* 中華)," the superior Chinese culture, standing in conflict with their own firm belief in the absolute truth of Christianity. The Jesuits and the Confucian scholars dealt with this conflict between their own fundamental beliefs and those of the other side in various different ways. Yet, the belief in the "Central Splendor" posed problems not only for the Jesuits. It posed problems for the Confucian scholars also because the existence of knowledge and methods of Western science containing aspects superior to those of the Chinese was in a direct conflict with their belief in the superiority of the Chinese culture in all areas, including science. In this paper I will show how the Confucian scholars dealt with, and came to terms with, this uncomfortable situation concerning Western science and their own scientific tradition. I will begin by discussing how Confucian scholars came to admit the superiority of Western science. I will then show that in their attempt to cope with this troubling situation, the similarities and congruences they found between the knowledge and methods of the Western science and those of ancient China played a pivotal role. The Confucian scholars tried to complement Chinese science with Western science, by incorporating the Western scientific knowledge and methods into the framework of Chinese scientific tradition.

Contribution ID: 1267

Creating a national time, adopting an international meridian: science in Brazil in the early 20th century.

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In 1913 Brazil created a national law unifying time measure and establishing four time zones in the country. Those time zones were calculated from Greenwich meridian which became, by the same law, the main reference for longitude calculation. The choice of this meridian is an important aspect that reveals the internalization of science in the early 20th century. Indeed, an international time system based on Greenwich Mean Time and an international time organization (*Association Internationale de l'Heure* and *Bureau Interntional de l'Heure*) were created at the same period. Brazilian scientists took part in many conferences and events related to that matter. The main interest of this presentation is to discuss a double scale present at national law time in Brazil. The first scale is quite obvious: creating a national, unified time was an attempt to consolidate Brazilian National State. In this sense, science was used to reinforce the unit of a very large and diversified territory. On

the other hand, the adoption of an international meridian indicates an internationalized science and a transnational scientific practice. In this perspective, circulation of scientists, instruments and objects between Brazil, Europe and the United States will be considered as essential elements to understand Brazilian science in the early 20th century and its conections with the creation of national law time in Brazil.

Contribution ID: 1193

Celebrity, media, and the construction of the environment under Franco's dictatorship in 1960s and 1970s Spain

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What is the role of celebrity in the processes of production, circulation and management of scientific knowledge? At the very least, this question takes us to the fields of science communication and popularization in relation to the construction of specific images of science, medicine and technology. It also leads us to focus on practitioners and their communication practices, and how these relate to their sociocultural and professional status as scientific authorities and to the validation of specific instances of knowledge. Such images, situated in particular social, political and cultural contexts, are reciprocally linked to media discourses and practices, whether aimed at strictly professional circles and/or beyond.
This work will offer a historical reading of the huge and prominent media output produced by Felix Rodríguez de la Fuente (1928-1980) in Spain in the late years of Franco's dictatorship and the changeover to the democratic administration. A pioneering and highly influential naturalist, activist and natural history author and broadcaster, he insistently blended his narratives about nature with the depiction of scientific and media practices, all within a complex cross-platform storytelling strategy in which television was pivotal. We will thus examine how, in such a noticeably socio-politically complex context, Rodríguez de la Fuente's natural history narratives combined the establishment's concerns regarding a long-sought modernization of Spain with an unequivocal construction of his own celebrity, and how this celebrity status played an ambivalent role in relation to the attainment of trust and credibility and the validation of scientific knowledge.

Contribution ID: 1332

Pafnuty Lvovich Chebyshev and the mathematical community of his time. On the occasion of the 200th anniversary of his birth (IAHS)

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Symposium Red Giants, White Dwarfs: Twentieth-century astronomy and astrophysics (History of Physics) - ID 228

Contribution ID: 251

The Socio-Epistemic Networks of General Relativity, 1925-1970: The low-water mark, the renaissance, and the astrophysical turn

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We report the results of our analysis of the development of general relativity between 1925 and 1970 based on the conceptual and methodological framework of the socio-epistemic networks. This framework defines knowledge networks as being composed of three different layers: the social, the semiotic, and the semantic networks. This computational approach is used to uncover the mechanism of the passage between the low-water-mark of general relativity (from the mid-1920s to the mid-1950s) and so-called renaissance of the theory after the mid-1950s. We provide substantial evidence that between the second half of the 1950s and the early 1960s there was an evident shift in all three layers. Our analysis disproves common explanations of the renaissance process. It shows that this phenomenon was not a consequence of astrophysical discoveries in the 1960s, nor was it a simple by-product of socio-economic transformations in the physics landscape after World War II. We argue instead that the renaissance has to be understood as a two-phase process both at the social and at the conceptual level. The first occurred between the second half of the 1950s and the early 1960s and was characterized by a return of interest in physical problems in general relativity proper for a growing community of scientists. We call this phase the renaissance of the theory. The second period, the astrophysical turn, was instead an experiment-driven process that started with the discovery of quasars and was characterized by the emergence of relativistic astrophysics and physical cosmology.

Contribution ID: 462

International astronomy in Chile. Scientists, politicians and the public in the 1960s

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The sixties were crucial years for international astronomy, and particularly intense for the development of astronomy in Chile. By the beginning of the decade, astronomers from the United States (AURA), Europe (ESO), and the Soviet Union (Pulkovo) went to the southern country, with plans of building massive observatories. After some time doing site testing, all these international actors decided to stay in the country. Before this scenario, Chile had limited experience in astronomy, mostly related to American expeditions. Therefore, in the 1960s, for Chilean scientists and politicians, this was a one-time opportunity to enhance the development of a sophisticated science that could support not only technological development, but also could be a symbol of the country's desired modernity. Even without a substantial number of local astronomers, they managed to set agreements in order to push for the development of international astronomy in Chile. Geographical conditions were certainly an asset; but also, Chile's latitude was of most interest for astronomers, for they could access a portion of the skies not visible from the northern hemisphere. This would be critical to study celestial bodies, but also to understand the universe as a whole and to move towards cosmology. Chilean press covered the progress of these massive projects, and contributed to constructing an image of astronomy as one of the country's evidences of its imagined excepcionalism. While related to the global Cold War powers, Chileans promoted American, Europeans and Soviets staying in the country, in order to embrace this new and promising science.

Contribution ID: 381

Imaginings and icons: imaging the cosmic first light, 1974-2014

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Throughout human history, light has been instrument, messenger, and the yet unknown in observations of the cosmos. The co-evolving empirical, theoretical, and mathematical sciences entangled with intuitions and imaginings of a spatial-relational nature and deep aesthetic sensitivities – ever interrogating, visualizing, and representing what lies just beyond the horizon of understanding. Compelled by a conjunction of accelerating theoretical, material, and technological advances, 20th-century physicists came to interrogate Einstein's general relativistic dynamic universe expanding from an initial singularity. By the turn-of-the-21st-century, the NASA missions COBE and WMAP and the ESA Planck space probe made visible the universe's very first light – the cosmic microwave background (CMB) radiation. Astrophysicists used the data collected from instruments on these satellites to produce iconic images mapping the density perturbations that were the seeds for growth of cosmic structures (galaxy clusters, voids, and superclusters). Theoretically anchored imagery modeled the evolution of cosmic structure from the big bang to today. Creative aesthetic concerns appeared at all stages in these missions, from instrument design to image production to public outreach. Throughout, tensions existed regarding meanings, visualizations, and mathematical and relativistic understandings, between ways of representing the first moments of cosmic expansion and our knowledge of that history, and between the epistemic and the ontic: even as precision measurements have narrowed the uncertainty in our periodizing and cataloging of cosmic evolution, the nature of the basic constituents of our universe remains under contention.

Contribution ID: 391

Curved space on a flat surface: the Event Horizon Telescope and visual representations of black holes

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The first image of the shadow a black hole was released by the Event Horizon Telescope Collaboration (EHTC) on 10 April 2019. Speaking at one of the press conferences in which this image was presented, Prof Heino Falcke stated that 'You have probably seen many, many images of black holes before, but they were all simulations or animations, and this is precious to all of us because this one is finally real'. In the years leading up to the release of this image, members of the EHTC had themselves used such visual representations to communicate black holes.
In the first part of the paper, I focus on the ways in which readers of *Scientific American* were encouraged to interpret visual representations of the surroundings of a black hole before the release of the EHTC image. Researchers from the EHTC often used visualisations from simulations from their research in their communication to non-specialists. Rather than isolated visual cultures for research and science communication, there were exchanges in a period when researchers learned how to produce images of black holes, while also communicating to audiences how to read potential images. In the

second part of the paper, I present the reception of the image following its release, with an emphasis on how audiences thought of it in relation to other types of visual representations, and how members of the EHTC felt about this reception.

Symposium Creating, maintaining and using technological systems: non-western actors - (ICOHTEC) - ID 159

Contribution ID: 267

Showing the way: maritime illumination in Japan, 1600-1900

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The global history of modernization is also a global history of illumination: where lights arrived, so did "progress." The installation of western-style lighthouses by French, British, and Scottish experts along the coasts of Japan starting in the late 1860s illuminated not only maritime routes, but also a freshly-minted modern nation aspiring to acquire international recognition.
A narrative that focuses on the acquisition of western technology on the part of non-European actors, however, skews our understanding of the early modern global world, perpetuating an Orientalistic narrative that portrays the "East" as perpetually catching up with the "West." This talk looks at three centuries of evolving maritime illumination in Japan to argue that maritime lights were in fact manifestations of mature political leadership well before the foreign intervention of the nineteenth-century.
This study relies on a variety of Japanese- and English-language sources, including newspaper articles, the memoirs of western consultants in Japan, government directives, local ordinances, ethnographic accounts, and legal cases.
A fixation with modern illumination, it concludes, blinds us to the nuances of the global past. If we set aside technological means and consider the motivations and efforts to micromanage the maritime night in Japan between 1600 and 1900, we can make a case for important parallels between the early modern and the modern eras, and between European and Asian actors.

Contribution ID: 528

A struggle between external aid and self-support: the financing of Puji Hospital in Dongguan, China

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This talk deals with the financial issue of the first German missionary hospital in China founded by the protestant Rhenish Mission -Puji Hospital 普济医院 1888-1949, and aims to clarify its main financial sources at different time intervals, the major shifts in financing and the deciding factors of such shifts. Exploring these questions helps demonstrate how Rhenish medical missionaries interacted in the financial aspect with their missionary society and the local society in China.

This study is based on the analysis of annual financial statements contained in hospital reports, written by Rhenish medical missionaries, either in German to update the home society on their work status, or in English and Chinese to raise funds in China. In this research I argue that its financing focus changed from heavy dependence on collecting before 1907, to self-sufficiency 1907-1937, and back to external relief since 1938. Before 1907, annual collecting among individual Europeans and Chinese in China constituted the major financial support, while funding from patients and the home society was limited due to the gratuitous character of the hospital and its subordination to the evangelistic mission - not financially burdening the funding for the proselytizing purpose. Thereafter medical missionaries managed to self-support by charging most patients except the destitute. Since the Japanese occupation of Dongguan in 1938, the hospital necessitated external aid again which came from individuals, the Chinese government, the largest indigenous charity, and international relief organizations, suggesting a positive interaction formed between the hospital and the Chinese society.

Symposium Knowledge and practice across borders: science in Islamic societies (CHOSTIS) - ID 550

Contribution ID: 642
The Arabic Translation of Marwazī's Kayhān Shināk ht

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Within the Islamic world the rich and longstanding tradition of astronomical texts was preserved and propagated primarily in the lingua franca of scholarship, Arabic. However, a small number of astronomical works written in other languages of the Islamic world have survived as well, most notably in Persian. Particularly rare in the latter category are Persian astronomical texts that were subsequently translated into Arabic. An instance of this Persian to Arabic transmission is the 11th century text *Kayhān Shināk ht* ("Knowledge of the Cosmos"), written by the noted polymath Qaṭṭān al-Marwazī (1072/1073 – 1153 CE). Like other pre-eminent scholars of his era Marwazī wrote prolifically on literature, medicine, engineering, and astronomy. His sole surviving work, however, is the aforementioned text on astronomy. Surviving in a single manuscript copy in Iran, this work is remarkable for having an extant Arabic version as well. A comparison of the surviving Arabic text with the Persian indicates that while the translation faithfully follows the original for many passages within the text, there appear numerous passages that are paraphrases. The existence of the Arabic translation of the *Kayhān Shināk ht* highlights an unexplored transmission route for the astronomical knowledge of the Persianate lands of Transoxiana to North Africa.

Contribution ID: 676
Eearly-modern European astronomy and Iranian religious elites

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In contrast to the cliché of "Catholic Church and Galileo," there is no document showing that the *ulama*, i.e., the orthodox Shiite scholars, issued a fatwā (official opinion) against modern cosmology. Nevertheless, there were some rejections, but not religious ones. One of the records of rejection appears in Mahdī Narāqī's *Al-Muṣtaqṣā* (before 1829), a comprehensive book in the tradition of hay'a books. Narāqī criticized the theory of the rotation of the Earth around itself as a "theory recently proposed by the Europeans," without mentioning the heliocentric theory. Narāqī, as a scholar in Ptolemaic astronomy, refutes this theory based on Ptolemaic experimental arguments. He never put forward a criticism based on religious discourses or holy texts, as a religious scholar. Muḥammad-Ḥussayn Shahristānī, as another religious scholar, in his *Āyāt Bayyināt* (*The Clear Signs* - 1881) proposed that although the new cosmology is in absolute contradiction with natural philosophy, the Islamic discourses are neutral about this theory.
Rather than orthodox ulama, the religious opponents of the modern astronomy were more among religious heretics of those times: the Shaykhists and the Gunābādī Sufists. KarīmKhān Kirmānī (1810-1871), the leader of the Shaykhism, and his followers published several texts (from 1858) criticizing the theory of the motion of the Earth, not only based on natural philosophical point of view but also religious discourses. Nūr'alīShāh Thānī (1867-1918), the leader of Gunābādī Sufism, in his *Najd al-Hidāya* (1901), did the same as well, however through different argumentations.

Contribution ID: 747
If the thumb is twitching … Palmomantic practices in Arabic sources

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Islamicate societies of pre-modern times know many manifestations and practices of prognostication, such as oneiromancy, geomancy, astrology, or palmomancy. They all have in common that they aim at learning more about the future. For this purpose, these practices interpret signs in the widest sense. In the order of appearance, they comprise dreams, figures on a tableau, astronomical phenomena, or spontaneous convulsions of parts of the human body. From lengthy lists of interpretations to elaborative texts with instructions, Arabic sources provide a broad range of tools to accomplish this purpose.
This talk will focus on palmomantic practices that are presented in the Arabic sources mainly as lists and tables. They associate parts of the human body and the corresponding prognostication. Further, the methods they use and their presentation will be discussed. In an outlook, this talk will touch on more general questions, e.g., the role of authorities in treatises dealing with mantic practices.

Contribution ID: 903
Science across the borders: al-Andalus and Byzantium in the 10th century

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In the 10th century, the Umayad caliphate of al-Andalus (Muslim Iberian Peninsula) maintained diplomatic relations with the Byzantine Empire because both had a common enemy: the Abbasid caliphate of Baghdad. The exchanges between the two states were very positive for the Andalusī

culture. For instance, crafters from Byzantium embellished the Great Mosque of Cordova with mosaics. The emperor Constantine VII sent at the request of the caliph ʿAbd al-Raḥmān III an exemplar of Dioscorides' *Materia Medica* because the Arabic translation that the physicians of Cordova employed was imprecise. We know that other books were sent from Byzantium to al-Andalus. Recent research suggests that these exchanges were more intense than it is usually acknowledged. Some sources of this period, particularly one version of a calendar known as *Calendar of Cordova,* contain textual elements of astronomy and agronomy that may have originated in the Byzantium. These materials will be analyzed in order to ascertain, on the one hand, whether they came from Byzantium or from elsewhere in the Mediterranean basin; on the other, whether they were transmitted by scholars or by sailors and merchants.

Contribution ID: 939

Andalusī pharmacognostical Ǧāmiʕ-texts: reflections on the evolution and dispersal of a local literary species

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Ibn Samağūn has been credited with an epoch-making role in laying the foundations of Andalusī research in the realm of drug-lore through the incorporation of a new text species to the pharmacognostical genre: the *Ǧāmiʕ*. His *Collection of the sayings of ancient and modern physicians on simple drugs* (being a selection of passages drawn from an apparently canonical *corpus* and punctuated by sparse authorial remarks) served as a model template for the work of like Ibn Wāfid, Alʔidrīsī, Alġāfiqī, and Ibn Albayṭār, while at the same time providing a ready-to-copy source of quotes from texts no longer in circulation. This peripheral product of the Arabic bookish tradition was to have a lasting impact in the overall Arabograph world and even beyond its borders in Christianate Europe.
Yet, as innovative as it may appear in its immediate context, the *Ǧāmiʕ* is not without precedents in the Islamicate tradition. In the east, Arrāzī's *Alḥāwī* (especially Book XXIII) and his still little explored *Alǧāmiʕ alkabīr* may be pertinent in this regard; on the west, the Qayrawānī school must have exercised its influence through such cognate works as Ibn Sulaymān's *Aġḏiyah* and Ibn Alǧazzār's *Iʕtimād*. Andalusī *Ǧāmiʕ*-texts are nevertheless different from both botany-oriented treatises with a focus on drug identification and medicine-oriented compendia inspired by a more Galenic approach.
In this paper we shall reflect on the genesis of this literary species in the Islamicate west and to trace its diffusion and further evolution both within and without its native Andalusī soil.

Symposium (Part 4/5) Art, image, and astronomical knowledge (ICHA/CHAMA) - ID 188

Contribution ID: 510

An early representation of a star pattern on an ancient Egyptian coffin of the first intermediate period (2181-2040 BCE)

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An ancient Egyptian wooden coffin lid from Naga ed-Deir has the painted depiction of five pointed stars on its inner surface, with the unique addition of blue-green dots in a distinct pattern at the center. This First Intermediate Period (2181-2040 BCE) coffin was discovered in the well-documented Reisner excavations from the early 1900s, and now is held in the Phoebe A. Hearst Museum of Anthropology at the University of California - Berkeley (PAHMA 6-20131). The use of five pointed stars on the roofs and inner top surfaces of funerary monuments was long established in ancient Egypt and represented the cosmic aspect of the desired eternal afterlife. The unusual inclusion of twenty-two dots was painted in a deliberate arrangement and patterning that strongly suggests that it was intended to represent an astronomical observation. The blue-green color of the dots was known in ancient Egypt as the color *wadj*, which represented the brilliance of the sun. The range of sizes in the dots could represent different magnitudes of brightness of the stars. A small selection of coffins from this time period include written charts of star observations, called diagonal star tables, that describe distinct decans. The Naga ed-Deir coffin has the potential to be one of the earliest attempts at an accurate visual observation of star patterns from ancient Egypt. Our collaboration between an archaeologist and astronomer has led to potential new understandings as to what area of the sky may be depicted.

Contribution ID: 519

Iconography and the cross-cultural transformation of zodiacal astral science in antiquity

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The introduction of the zodiac in Babylonia in the 5th century BCE was a turning point in the history of astral science, scholarship and culture at large. The "zodiacal turn" in astral science was accompanied by a "mathematical turn" and a "personal turn" in astrology. From Babylonia, zodiacal astral science spread to Egypt, the Greco-Roman world and beyond. How did zodiacal astral science emerge, develop and spread to different ancient cultures and take root there? What explains the enormous success of this cross-cultural phenomenon? The ZODIAC project addresses these questions with an interdisciplinary study of cross-cultural transformations in textual and iconographic sources that use the zodiac. In this paper I will present selected sources to exemplify open questions, research opportunities and methodological issues.

Contribution ID: 298

Images in Babylonian astronomical and astrological texts

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A small number of astronomical and astrological cuneiform tablets contain inscribed drawings. These drawings fall into three main groups: (i) drawings of the moon, sun, planets and stars depicted

respectively by the lunar crescent, the solar disc, and stars with varying numbers of points, (ii) figurative representations of constellations and the signs of the zodiac, and (iii) dot-and-stick representations of constellations. In this paper I will review these different ways in which stars, planets and constellations are depicted on cuneiform tablets and compare the drawings with prose descriptions of the same bodies. I will also consider the relationship between the drawing and the text written on the same tablet in order to further elucidate the reason why a particular depiction of a celestial body has been chosen for the drawing.

Symposium (Part 2/2) Pedagogy beyond giants and dwarfs: using the history of science to enhance education and promote inclusiveness - ID 551

Contribution ID: 749

Changing pedagogical landscapes of the history of science and 'Two Cultures'

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This paper reflects on the changing institutional and political landscapes of the 'two culture's debate in education– both, at the start of the history of science, and now. It discusses how pedagogical visions for our field have shaped and been shaped by relationships between humanities and sciences in colleges and universities, as well as by evolving scholarship in history education and the history of science education. It briefly reviews and connects three themes: re-historicizing history of science and science education; experimenting with history of science in General Education; and the benefits and challenges of interdisciplinary collaborations (especially collaborative co-teaching with scientists). Finally, it reflects on how COVID-19 and summer 2020's Black Lives Matters activism further call us to and shape pedagogical reforms.

Contribution ID: 748

Reconstructing Early Modern Artisanal Epistemologies and an "Undisciplined" Mode of Inquiry

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Since 2014, the Making and Knowing Project has been teaching hands-on history of craft and science through the lens of an early modern manuscript compilation of artisanal recipes (edition640.makingandknowing.org). The Project has aimed to cultivate a mode of inquiry in students that predates our modern disciplinary divisions between the arts and sciences. This paper highlights the advantages and challenges of cultivating student skills through an intensive program of problem-based pedagogy, and it features the Project's recent experience teaching hands-on, experimental modules to a virtual class of students, distributed across the country in the wake of COVID-19 campus closures. This

unusual teaching opportunity allowed the Project to test drive components of its forthcoming Research and Teaching Companion, a guide to help users integrate exploratory, question-generating experiments into the classroom and project design.

Contribution ID: 786

History in the education of scientists: Encouraging judgment and social action

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In this talk, we reflect on the experience of co-teaching a course on the intertwined history of genetics and concepts of race. We teach at Harvey Mudd College, a small liberal arts school that promises to educate scientists, mathematicians and engineers who will graduate with an understanding of the impact of their work on society. With this goal as our starting point, we launched the course by asking questions about current debates in genetics and medicine: What does it mean when biologists point to significant genetic variation across human populations? Are they offering evidence for the same racial categories which have enabled horrific and continuing violence and discrimination? Are they providing a framework for more effective medical treatments? As a historian of science and a biologist, this collaboration pushed us both to consider how to make space for moral and scientific judgment in a history classroom. Drawing on examples from this course, we argue that it is possible to encourage social action and thoughtful critiques of past and current science without succumbing to a Whiggish narrative of progress.

Contribution ID: 790

Co-teaching Botany and History: An Interdisciplinary Model for a More Inclusive Curriculum

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This paper offers numerous ideas on how to integrate science and history into classroom pedagogy in a way that acknowledges the contributions of women and other groups underrepresented in science by highlighting the cultural and political contexts in which science developed rather than by adding token individuals to a history of science still largely defined by the achievements of a few great men. It details how students in a general education class co-taught by a botanist and historian of science at The Evergreen State College not only gained skills in field botany and vegetation analysis, but also became more informed about how modern scientific disciplines took shape. Recognizing that race, class, and gender have played a role in how science developed, the students' understanding of the complicated legacy of scientific inquiry gave them tools to be more rigorous in their thinking about scientific practice. This interdisciplinary approach, so crucial in fostering inclusivity in scientific disciplines, also promoted a deeper engagement with historical inquiry.

Symposium Scientific and Cultural Influences of Ptolemy in China - ID 517

Contribution ID: 814
Data analysis of the historical records of Sun, Moon and planets in Ming Shilu

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More than six thousand celestial events were recorded in the *Ming Shilu*, official chronicle history book of the Ming Dynasty. There are 336 records of eclipses and 2622 records of the Moon and planets occulting or approaching stars. The records of solar and lunar eclipses cover most actual visible eclipses in the capital. Some eclipses were visible from other countries due to inaccurate forecasts. The eclipse records echoed with many records of rescue ceremonies in the Ming Dynasty. The error rate of the lunar or planetary approaches or occultations, 4.1%, is the best of past dynasties. The errors should be mainly caused by process of data compilation and book copying. From the relative records, it can be seen that the names of the stars in constellation are slightly different from tradition names.

Contribution ID: 856
Ptolemaic Planetary Theory in Qizheng Tuibu (1477)

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In 1477, Bei Lin (1429-1482) revised and issued the *Qizheng Tuibu* (*On the Motions of the Seven Luminaries*, 7 volumes, one canon and six tables), a revision of the original *Huihui Li*, translated and compiled from Islamic astronomy. Several strong related versions of *Huihui Li*, the *Sanjufīnī Zīj* (1366), the *Outer Valume* of the *Chiljong San* (1444) and the *Tōhoku manuscript*, have been scrutinized. The planetary theory, canon text of volume 1, table 5 in volume 2, Tables 15, 16 in volume 3, and Tables 17-33 in volumes 4-6 of the total 39 tables, in *Qizheng Tuibu*, followed the tradition of Ptolemy (*c.* 100-*c.*170) in *Almagest*, although different parameters and calculating formulae had been applied, the longitude for the first and the second equations have been derived from the formulae which are of the improved forms in *Almagest*, the latitude double-argument tables as functions of the true centrum and the true anomaly have been tabulated in user-friendly forms and the inclination and slant have not been given, the related tables in *Sanjufīnī Zīj* (1366) are abbreviated versions of these in *Qizheng Tuibu*. Furthermore, the calculated values in the plenatary tables in *Qizheng Tuibu* are unique and different from these in *Almagest*, the various z*ījes* of the School of Maragha in the 13th c. and of Samarqand in the 15th c.. Islamic and Chinese astronomers in the Yuan (1271-1368) and Ming (1368-1644) have made distinctive contribution to the introduction and development of the Islamic astronomy in China.

Contribution ID: 857
Studies of MYTWS Versions: Communication of Ptolemaic astrology from Islam

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According to the records of historical materials, there were some scriptures named as "*Du-li Yu-si*" in the Tang and Song Dynasties which in the form of rhymes. Astronomers from Persia or India spread them as a tool for popularizing Ptolemy's astrology. At present, most of the them are scattered and lost. The only *XTYSJ* (*Western Yu-si Scriptures*) currently seen is stored in *XXDC* (*Integration of Astrology*).
In 1273, Ai-hsieh collected a batch of astronomical and astrological works from Maragha. Among them is the well-known astrological book *Al-mudkhal* that written by the Persian astronomer Kūshyār ibn Labbān Bāshahrī al-Jīlī. And it was translated into Chinese in 1382. Compared with "*Du-li Yu-si*", *MYTWS* (*Book of Astronomy: Officially Translated by Order of Ming*) is more complete and conformable to the tradition of *Tetrabiblos* in structure, chapters and content.
Firstly, the report will clarify the basic situation of Ptolemy's astrological thought in China. Secondly, discuss the version of *MYTWS* and show the attitude of the Ming and Qing dynasties towards Western astrology. Thirdly, talk about the relationship between the catalog in *MYTWS* and other relevant tables. Finally, discuss the influence of *MYTWS* on Xue Feng-zuo and the school of Wu-an.
From *XTYSJ* to *MYTWS* to *TBZY* (*Translation and compilation of In Cl. Ptolemaei Pelusiensis IIII de Astrorum Iduiciis*), it reflects the development of pre-Islamic, Islamic, and Islamic-affected European astrology in China. At present, the research of this area has not been fully related . And the possible influence from the Silk Road behind them.

Contribution ID: 1077

A study on Ferdinand Verbiest ' s star catalogue

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Ferdinand Verbiest published the Xinzhi Lingtai Yixiang Zhi (<新制灵台仪象志>) in 1673. There are series of star catalogues which contained the position of more than 1800 stars totally in it. This study researches into the Verbiest's star catalogues and other catalogues, as well as the star map, arising in the course of Chongzhen calendar reform at the end of Ming Dynasty. Through the comparison to several corresponding catalogues and the analysis of the consistency between the corresponding data of star maps and catalogue, this research proves that: Jesuits were always modifying the star data for 40 years, even though Verbiest's star data mostly coming from the earlier catalogue; there is a unpublished star catalogue which contained more stars than the one in Chongzhen Lishu (<崇祯历书>) at the end of Ming dynasty; practically, people observed stars anew on the basis of western star catalogue or star map for reference during Chonzhen calendar reform.

Contribution ID: 919

From Nestorians to Matteo Ricci: Ptolemaic Influences in China

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In 714, Superintendent of Customs at Guangzhou 廣州 and a Persian monk (Nestorian Christian Bishop Jilie or Gabriel) received an imperial order from the Tang court to make some "unusual instruments",

possibly including some astronomical-astrological instruments or related devices based on the Ptolemaic system of astronomy. Later in the century, the courtesy name of Persian Nestorian astronomer Li Su 李素 (743-817) was listed among the names of Syrian Christian clergies to be engraved in Chinese and Syriac on the Xi'an Nestorian stele dated 781. Nearly a millennium later, the projective drawing "analemma" of Ptolemy (c.100-178) appeared on Matteo Ricci's (1552-1610) influential world map of 1602 (*Kunyu wanguo quantu* 坤輿萬國全圖). This paper will give a succinct account of Ptolemy and his scientific and cross-cultural legacies through centuries in China.

Contribution ID: 1170

Preliminary study on the inner planets observations of Ptolemy in Chongzhen Lishu

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Ptolemy's planetary theory had a great influence on the development of mathematical astronomy in both the East and the West. Having compared the observation records of inner planets in *Chongzhen Lishu* (Chongzhen reign-period Treatise on Calendrical Science, 1629-1634; *Xiyang Xinfa Lishu*, 1645), *Almagest*(1528), *De Revolutionibus Orbium Cœlestium, Libri VI*(1543) and *Astronomia Danica*(1620), the author has realized that 9 observations of Venus by Ptolemy or recorded by Ptolemy have been translated in *Wuwei Lizhi* vol.5 chap.3 &chap.6, and 5 observations of Mercury or recorded by Ptolemy have been translated in *Wuwei Lizhi* vol.6 chap.4, chap.7 &chap.9 of *Chongzhen Lishu*. These observation data are consistent with *Almagest*. *Chongzhen Lishu* retained 9 of the 11 Venus observations in *Almagest*, but omitted most of the Mercury observations, and at the same time completely recorded Tycho's observations of the inner planets. *Chongzheng Lishu*, has not only introduced the newly developed planetary theory in *Astronomia Danica*, but also took full advantage of the observation data of Ptolemy, Copernicus and Tycho, among which Tycho's observations was the most complete and more preferred one, and Ptolemy's observations were included as the representative of ancient astronomical observations.

Symposium (Part 13/14) XL Symposium of the Scientific Instrument Commission (SIC) - ID 218

Contribution ID: 409

The 'Physikalisches Kabinett' of the Prince-Bishops of Würzburg – A Roman-Catholic Collection?

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In 1877 the Bayerisches Nationalmuseum in Munich acquired the 'Physikalisches Kabinett' of the University of Würzburg, comprising about 135 scientific instruments of the 18th century. These deal for example with astronomy, chronometry, optics, mechanics, mathematics, and electricity, most of which

are still extant in the holdings of the museum. Founded originally in 1402 as one of the oldest universities in Germany, the University of Würzburg flourished under the patronage of the prince bishops of Würzburg and hence in a Roman-Catholic state until the secularisation in the early 19th century. As there is probably no wider awareness of this collection today, the presentation aims first to give a visual overview of the objects which apart from a few pieces have not been on display for a long while. In a second step it will be discussed if and to what extent the scientific instruments show distinctly Roman-Catholic features. This applies especially to the most prominent piece, the huge planetarium by Johann Georg Neßtfell from about 1755/61. This represents both the heliocentric model and, surprisingly, Martianus Capella's geo-heliocentric model (not the Ptolemaic system, as previously thought). Finally, attention should be given to other distinct objects of the "Physikalisches Kabinett" which are remarkable also in comparison with other collections, to conclude if there is something like a religious influence on this particular collection.

Contribution ID: 417

Instruments to measure character – religious practitioners and psychological testing in the United States, 1920-1940

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The first half of the twentieth century, particularly the years during and after World War I, saw a rapid expansion in the design and use of paper-and-pencil psychological tests in the United States. Much of this testing was intended to measure general intelligence, aptitude for particular vocations or disciplines, and achievement in various school subjects. A few psychologists also sought to quantify differences in student behavior, character, and social maturity. Several tests of this sort were developed by people with strong religious beliefs. Those discussed include a research associate at Columbia University named Mark A. May (1891-1997) who studied at Union Theological Seminary before obtaining his PhD. in psychology at Columbia in 1917, participating in the U.S. Army's World War I testing program, and developing tests as part of character inquiry (May would go on to become a professor at Yale University). Also to be considered are a priest at Catholic University named Paul H. Furfey (1896-1992), who prepared and published a test for developmental age; and an American missionary to China named Lennig Sweet (1893-1973) who, while home on sabbatical, authored a test of personal attitudes as a graduate student at Teachers College of Columbia University in the late 1920s.

Contribution ID: 571

What's in a label?: 'Science' and 'Religion' in a museum context.

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Labels are as old as museums collections, they give the audience something to read, learn, or appreciate while engaging with the objects. Yet, they are often overlooked, or taken for granted. Their role is crucial, as they often are the main entry point for the audience to understand the objects and give, in a

few words, basic information and key points to grasp the meaning of the collection. For complex or unfamiliar items, such as scientific objects including astrolabes, this problematic stands out even more. Interpreting objects and explaining intricate concepts in a few words is one of the great challenges for museums.
Each word counts and must be chosen with the greatest consideration. The purpose of a label is to meet the audience, and raise viewers up to a better understanding, whilst not losing their focus.
What do we want to highlight in the objects? Why? And how? Are the labels, as they are currently written, sufficient, or relevant enough?
The analysis of the vocabulary and terms that were chosen by our predecessors, and the very provenance of these words, can be very illuminating. And so is the process of writing new labels.
Thus, the aim of this talk will be to discuss the current labelling of scientific instruments and their religious context(s) in the museum, and to propose alternative ways for their presentation.

Contribution ID: 379
Science and religion – knowledge and faith. A practical museum approach

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Does an object that is used in a faith-related context have an inherent religious meaning or does the meaning change depending on the context in which it 'exists'? Should objects that were created for use in a religious activity ever be stared at in museums or does this desecrate them? What about scientific objects that aid activities of the faithful – should they be displayed in a science museum or in a neighbouring Islamic or Christian art museum?

This presentation explores these questions in the light of a radical redisplay of the History of Science Museum in Oxford which has some of the world's finest instruments that have hitherto been described as 'Islamic' – as well as an equally fine range of artefacts that might legitimately have been described as 'Christian', but never were.

Symposium Constructing interfaces between mathematical and physical conceptions and methods, c.1850–1930 - (ICHM) (with IMU) ID – 97

Contribution ID: 800
Repeating the words of power: Hamiltonian dynamics and physical speculation in late nineteenth century Britain

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"It is remarkable how slow natural philosophers … have been to make use of [Hamiltonian] methods… [But] now the feeblest among us can repeat the words of power and take part in dynamical discussions" (Maxwell, 1879, Review of Thomson & Tait).

Thus, James Clerk Maxwell, William Thomson and Peter Guthrie Tait argued for the strength of Hamiltonian methods. Holding that such knowledge was epistemically strong in two of the ways suggested by Epple (2020, The Theaetetus Problem) - rationally, as it used mathematical (presumed logical) chains of reasoning, and empirically as it coordinated macroscopic observations – they constructed their own cultural strength as "giants" in nineteenth-century British physics.
The epistemic weakness of their position is revealed in challenges by lesser-known mathematicians such as John Purser of Belfast, or Carl Neumann of Königsburg: under-determination by the postulated underlying mechanisms – ethereal vortices - of the coordinates required by Hamiltonian dynamics. The issue became acute after 1877 when, in response to questions around mechanical stability, the Cambridge mathematician Edward Routh developed a "modified Lagrangian", showing how some coordinates might be cyclic, not explicitly entering the Hamiltonian of the system. This rendered mechanisms unobservable and hence unknowable.
This presentation explores the ways in which this very weakness may have been liberating, providing a space in which speculative mechanisms became conceptual objects that could be explored mathematically and were heuristically valuable, yet whose empirical reality could be disavowed.

Contribution ID: 801
(No) Love at first sight - group theory and quantum mechanics

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In the mid 1920s new quantum mechanical theories were developed in order to overcome a situation that was perceived as a crisis in quantum theory by some physicists. It is within this context that group-theoretical methods made their first appearance in quantum mechanics in contributions by Wigner, Heisenberg, Dirac, Weyl and van der Waerden.
Soon, however, the term "group pestilence" was coined and circulated among physicists - apparently showing strong resistance to the new methods. In this talk I will, on the one hand, put forward a more nuanced interpretation based on the origin of the term, and, on the other hand, explore group theory as a form of contested, i.e. "weak" knowledge in the context of quantum mechanics. By analysing the contemporary discourse on group theoretic methods in quantum mechanics I will explore the ways in which group theory was considered as "weak". I will present in detail the different dimensions of "weakness" (epistemic, social, and practical, see Epple/Imhausen/Müller 2020) of group theory at the time. This will show the broad spectrum of reactions to the introduction of group theory into quantum mechanics. It might also help to explain why it took so long for group theory to become accepted as the basic constituent of particle physics that it is today.

Contribution ID: 808
High dimensional spaces and mechanical systems

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In advanced textbooks, rational mechanics is often presented as a kind of geometry of either configuration- or phase space. How did the physical theory of mechanics and the mathematical theory of

geometry of high dimensional spaces merge? One meaningful historical account runs as follows: In the middle of the 19th century Riemann, Gassmann and others generalized geometry to spaces of higher dimensions and then physicists *applied* this mathematical concept in their presentation of mechanics. However, one can also tell another story: When Lagrange introduced generalized coordinates of mechanical systems, it became natural to deal with the collection of these coordinates in a way analogous to coordinates of a point in space, but now having more than 3 coordinates. Mathematicians such as Liouville explored this analogy and found beautiful analogies between differential geometry of surfaces and mechanics of systems of points. A similar approach was followed by Darboux in his many volume work on differential geometry. After having dealt with geometry of curves and surfaces, he turned to mechanical systems. In this way the analogy between mechanics and geometry allowed him to deal with higher dimensional systems without needing to introduce the controversial concept of a high dimensional space. Hertz, studied mechanics as a *geometry of systems of points*, that he explicitly considered as analogous but not conceptually equal to geometry of space. In this second more subtle version of the history, geometry and mechanics play more symmetric roles, each of them influencing the other.

Symposium (Part 2/2) Symposium_Gender and technological systems (ICOHTEC) - ID 120

Contribution ID: 138

Women making noise: sound, power and gender from stage to studio

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In the early twentieth century, instructions for the Edison home recording phonograph appealed equally to women and men, suggesting no assumed gender bias regarding who might be likely to manipulate the controls of this new device. By the 1950s, literature promoting the home high fidelity craze assumed a domestic division of labor that had men controlling the stereo and women controlling the vacuum cleaner. Likewise, the profession of sound engineering was a masculine domain that discouraged women from applying. Men dominated the controls in sound venues, from recording studios to rock concerts, exemplifying the "underlying nexus between masculinity and technology," characterized by Judy Wajcman in *Feminism Confronts Technology* (1991). By the early 1960s, young women were challenging this dominance in the realms of music performance and sound engineering. Rejecting the path to domestic bliss encouraged by their mothers, and inspired by rock and roll and the power of amplified sound, they formed all-women rock bands, sought studio jobs, and operated sound reinforcement equipment. Yet even with the groundswell of 1960s second wave feminism and demands for equal rights in the workplace, the sound studio and rock music industry remained bastions of male dominance well into the twenty-first century. Based on oral interviews and memoirs, feminist literature, music histories and technical periodicals, this paper explores the experiences of women in sound engineering, and rock music performance in the post-World War II United States, Finland, and Sweden, in an effort to understand the entrenched barriers to acceptance of women in these professions.

Contribution ID: 292

Finding reproductive freedom in biologistic thinking

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The oral contraceptive pill (OCP) has had enduring consequences for the liberatory imagination. Clustering around the proliferation of the birth control pill after 1960, I investigate an intertextual conversation between a trio of literary experiments: Ursula Le Guin's 1969 *Left Hand of Darkness*, Shulamith Firestone's 1970 *Dialectic of Sex*, and Carl Djerassi's 1998 *Immaculate Misconception*, arguing that these works employed speculative literary techniques to interrogate the naturalness and immutability of female sex, and to envision a radical future vis-à-vis gender, reproduction, and technology. Running counter to much of the modern Western feminist tradition, which critiqued biologically-deterministic thinking for its oppressive unfreedom, they found a path to liberation *via* biologism. In this story about the cultural aftereffects of oral contraceptive technology, I sketch out a possible terrain of a techno-optimistic feminism that emerged at, and was inflected through, this historical juncture of the commercialization of the OCP, channeling and refracting some of the social and gender theorizing energies of the period through the OCP's idiom and example. And yet, for all of their optimism, within these fictions is contained the emergent edge of the technologically-assisted abuse that potentially accompanies technological-assisted liberation.

Contribution ID: 306

"Boys will be boys": gender, plug sockets, and electrical safety in the interwar British home

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This paper examines the ways in which plug sockets intersected with notions of gender in interwar Britain, and how engagement with plug sockets as a "user interface" helped shape the new conceptions of motherhood and boyhood that were developing during this period. By extending STS scholarship on users and consumers of technology, this paper demonstrates that the classic historiographical narrative of female anxiety about electricity affected a wider range of technologies and "lay end users" than scholars have previously acknowledged. The history of boys as misusers, or potential misusers, of electrical technologies explored here both extends and complicates dominant narratives of the domestication of electricity that focus primarily on housewives. More specifically, it shows how British companies like M. K. Electric attempted to rewrite the scripts of technological engagement by adapting the physical sites of engagement, as well as interpreting them for their users through the medium of advertising. Such decisions were part of the electrical industry's broader interest in addressing concerns about the safety of electricity by locating risk in the bodies of users rather than the technologies themselves. Overall, as sites where anxieties about the contact of young boys with electricity were manifested, plug sockets offer insight into the co-construction of technologies and gendered narratives of their use (and misuse). Through advertisements, trade journals, newspapers, magazines, and household manuals, this paper considers the marketing of domestic electrical technologies in the

broader context of anxieties about the domestication of electricity that intensified and changed in character in interwar Britain.

Symposium Technological Teams (ICOHTEC) - ID 616

Contribution ID: 959

From big science to team science

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This paper discusses the evolution of scientific collaboration in the United States (U.S.) from the 1940s forward, focusing on organizational structure, technology interdependence, and performance as well as the variety of ways national agencies, universities, and industries approached scientific endeavors that required alliances.
The paper explores the evolution of structures for scientific collaboration from endeavors focused on shared data acquisition (e.g., building and operating large scale instruments such spacecraft, ground-based astronomical observatories, and accelerators), to shared data analysis (e.g., harnessing multiple data sources for global statistics or development of new computation for simulation), to research focused on understanding and managing circumstances that facilitate or hinder effectiveness and evaluating the outcomes of collaborative science. It explores the role of factors such as funding, duration, number of organizations engaged, team size, number of disciplines, and level Aof trust or conflict. Examination of structures provides insights on management, communication practices, relationships among scientists, and scientific and societal outcomes and impacts.
Persons attending this presentation will gain an appreciation of the evolution of science in the United States in the post-World War II era, be able to associate evolutionary phases with changes in enabling structures and methods, and be poised to consider implications for historians.
The paper examines information from archival materials of scientific collaborations as well as subsequent commentaries by historians, scientists, and other researchers.

Contribution ID: 984

Vicente Marcano (1848-1891), polymath chemist, discoverer of the Bromelain enzyme, and father of experimental science in Venezuela

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Vicente Marcano (VM) is considered the forefather of experimental science in Venezuela. He was a multidimensional scientist who worked in several disciplines — agricultural and tropical chemistry, food technology, and geochemistry. He also made contributions to anthropology and ethnography, wrote short stories, promoted the creation of literary associations, participated in the political life of Venezuela, and, until the second half of the 20th century, he held the record of most caves explored in Venezuela.

VM was the Commissioner-General of the Venezuelan delegation to the *Exposition Universelle 1878* in Paris.
VM carried out most of his research in laboratories set up by himself in Venezuela. In the pineapple juice, he discovered a proteolytic enzyme called Bromelain. To receive international recognition for all his research done in Venezuela, get it published in France, and to have some of his experiments replicated in Paris, VM built a Franco-Alsatian knowledge network (Wurtz-Berthelot-Duchartre-Schloesing-Naquet-Boussingault-Müntz). He obtained several patents of invention related to the discovery of the Bromelain, which were used by one of his former associates to start a business venture in the United States.
This paper provides new insights into the education of VM at the École Centrale of Paris, describes his Franco-Alsatian knowledge network, and presents his patents of invention. Here, we are reporting the results of the application of the Digital Historical Sounding methodology to a 19th-century case study. This is a methodology created by the author to use the Internet and social networks to make biographical profiles of scientists, technologists, and scientific institutions.

Contribution ID: 995
Invention or Business? Pioneers of the television technology and industry -Vladimir Zworykin and David Sarnoff.

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A Russian emigrant Vladimir Zworykin began working in the USA as an engineer for the Westinghouse in 1920. Working essentially alone, he developed an electronic television installation and in 1923 submitted an application for the invention of a new type of television system. An experimental setup did not make a big impression on the company's management, after which the inventor was given another job.
David Sarnoff, Vice President of Radio Corporation of America (RCA), otherwise appreciated significance of the completed development. In 1929 he invited Zworykin to work at RCA as head of the electronics laboratory. Being in the know of new developments in this area, Sarnoff believed in the prospects of the television system by Zworykin, thus providing great support to his work, even during the Great economic depression.
In 1936, RCA conducted a pilot broadcast of electronic television programs using a transmitter installed in the Empire State Building in New York. In 1939, at the New York World's Fair, David Sarnoff announced the beginning of the era of mass television in the United States. 15 years later, at the celebration of Zworykin on the occasion of his 65th birthday, Sarnoff will say: "Thanks to electron, RCA has turned from a small company with modest funds into a leader of a huge industry. True scientific spirit, close cooperation of colleagues with Dr. Zworykin became the source of the results that we are so proud of."

Session XXIII (Part 2/2) - Science Theory and Praxis
Contribution ID: 1027
Denialism in Brazil: a review of the dispute between post-thuth and science

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Amid the biggest pandemic of the century and a context of political polarization that has as its background a growing authoritarianism, Brazil finds itself in the midst of a public debate marked by the institutionalization of denialism. The official communication channels of the Brazilian State and the positions of its main representatives minimize the deaths recorded by the new coronavirus, blame unrealistic enemies and try to mask the widespread incompetence of the current federal administration in dealing with the crises that arise each week. The denialists ideas have been maximized by the dispute of narratives triggered by the phenomenon of post-truth. The constant denial in conjunction with the historical revisionism that has as its central figure the President of the Republic himself, takes on dramatic airs as a result of the constant attacks on education and science. Scientific knowledge has been presented to the population as a narrative, founded in the interest of hidden enemies. In the meantime, the rescue of Enlightenment values is essential for the popularization of science and the constitution of rational elements that serve against the irrational elements of the current debate. In this paper, I intend to analyze how Brazilian denialism has been enhanced and how it represents a danger to Enlightenment values.

Contribution ID: 1152

Hierarchy within the Soviet scientific community: filters and positions of the 1920s

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This abstract is dedicated to the transformation of the Soviet scientific community under the influence of the fundamental processes in the science of the 1920th as they turn from individual enterprise into a large-scale well-organized industry uniting significant human and material resources. The community grew significantly larger, became mere diverse and open. This changed the social makeup of the scientific community and helped develop specific types of internal hierarchy and competition. The author addresses a number of issues. What groups constituted the scientific community and how did they interact with each other? How did the positions of researchers differ across the disciplines? How important was it to be a member of the All-Union Communist Party of Bolsheviks to advance in one's academic career? Rather than focusing on the fates of individual scientists, author explores different scientific groups that formulated collective strategies of adaptation to various historical challenges, mechanisms of competitive survival and hierarchies, revealing hierarchical mechanisms and principles of (self)organization of the scientific community. Most of the data for analyses comes from sociometry and scientometrics of the Soviet scientific community in the 1920s.
Acknowledges: Russian Science Foundation, No. 20-78-10095.

Contribution ID: 1275

Scientific fakery: from the early modern to contemporary times

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For as long as there have been scientific publications, there have been scientific fabrications. Although some consider 'fake news' to be a modern phenomenon, false accounts played a significant role in the

development of early modern natural history, appearing in texts as influential as those of Clusius and Aldrovandi. This paper will examine false reports from sixteenth-century travelogues, examining why and how they were produced alongside how they were received. The conditions that permitted the spread of false information in the early modern period – novelty, broad and cheap information distribution, shifting standards of scientific authority – will then be compared to conditions today, where the Internet has allowed false reports to spread in connection with anti-vaccine and Flat Earth scepticism. In the process, this paper will argue that analogies can be drawn between the two periods that may help us address the spread of false information in our own time.

Symposium (Part 4/4) Mathematical proofs and styles of reasoning: East vs. West - ID 226

Contribution ID: 373

Abū al-Barakāt's diagram method in logic

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Abū al-Barakāt bin Malkā al-Baghdādī, identified with Rabbi Baruch ben Melekh, was a highly original thinker based in Baghdad in the twelfth century. In his main philosophical work *Kitāb al-mu'tabar* he sets out a novel proposal for doing syllogistic logic, using diagrams that consist of labelled horizontal lines. A literal implementation of his method as a C++ program gave in a few seconds all of Aristotle's results about conclusions or absence of conclusions from premise-pairs in syllogistic logic, together with other logical information.
Barakāt himself advertised his method as intuitive and free from Aristotle's methods for proving conclusions. Both claims seem to be correct. In fact the diagrams are not related to those of Leibniz, Euler or Venn, which essentially give pictorial versions of Aristotle's sentences. Instead they represent the different forms of model of the premises, so that one can hunt through them and see if there is a constant conclusion. In this way they are the syllogistic version of Tarski's 'model-theoretic consequence' of 1936. The published text of his work is full of inaccuracies, but inspection of the manuscripts makes clear that his own calculations were virtually error-free and the mistakes arose from the very unusual challenge that his text presented to the copyists. Among many unanswered questions about this astonishing work is to determine in what sense he regarded his method as a form of reasoning.

Contribution ID: 476

Geometry and Arithmetic-Analysis and Synthesis in Ancient Greek Mathematical Tradition

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The discussions of the method of Analysis and Synthesis in the Ancient Greek Mathematical tradition were mostly based on the description of this method by Pappus of Alexandria in the introduction to Book

VII of his *Collection*, where he speaks of the "Treasury of Analysis" (τόπος ἀναλυόμενος) and Proclus' in disperse passages of his *Commentary to Book I of Euclid' Elements*. Heron of Alexandria in the *Commentary on Euclid's Elements* (from which very few fragments survive in Greek preserved in Proclus, but a large number of extracts has been preserved in the commentary of an-Nairītzī in Arabic), gives a definition of analysis and synthesis. Also, in his *Metrica* he proves by using the method of analysis -named by modern scholars' metrical analysis- and synthesis where he uses geometrical and computational-arithmetic elements that serve as a justification and an explicit generalization. In our presentation we are going to discuss Heron's original "mixed" approach.

Contribution ID: 858
Understanding computer-assisted proofs

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The paper studies the problems in understanding computer-assisted proofs, proceeding from the case of the proof of the Herbert Ellis Robbins' conjecture. William McCune proved the conjecture in 1996, using the Equational Prover, that is an automated theorem proving program for first-order equational logic. Further, McCune's proof was successfully verified by another automated theorem-prover for first-order and equational logic, called "Otter". Nevertheless, the computer-assisted proof remained unintelligible by humans until its translation (interpretation) by Kauffman into a diagrammatic language of nested box algebra.
Kaufman's attempt was the first case of representation of proof in a graphic manner. Since then, the attempt to understand proof using translation (interpretation) was extended in many other fields, including formal methods and explanatory artificial intelligence. We will suggest a classification of these attempts and the formulation of a general framework for the explanatory nature of proofs (and their translations) using concepts from the category theory and the theory of institutions

Symposium (Part 5/5) Art, image, and astronomical knowledge (ICHA/CHAMA) - ID 190

Contribution ID: 500
Knowledge, art and politics in copies of 'Abd al-Rahman al-Sufi's Book of the Star Constellations

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In the very elaborate introduction, al-Sufi dwelled on knowledge giving institutional aspects a secondary place and none to the arts or politics proper. This clearly changed already during his lifetime when he taught his work. The importance of visual representation and its connection with political statements and

self-representation as parts of the use of al-Sufi's text increased since the twelfth century meeting in different moments with elements connected to the knowledge imparted by the book.
In my talk I will discuss the different aspects that made al-Sufi's book into the most often copied illustrated scientific book of the Islamicate world.

Contribution ID: 297

Charting the Chinese Sky with Western Observations: The Star Maps Made by Jesuit Astronomers in the Late Ming Dynasty Revisited

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When Jesuit astronomers tried to introduce European knowledge on the fixed stars into China in the late Ming dynasty, they were facing a long and well-established tradition of cataloguing and charting the starry sky that was different from their own but charged with deep ideological meanings. This created a difficult situation for them to deal with: on the one hand, they hoped to show the superiority of European astronomy through more stars catalogued and charted by their own astronomers; on the other hand, they had to keep the "Chinese features" in their depictions of the starry sky. I argue that to achieve this goal the Jesuit astronomers and their Chinese followers made a series of reconciliations which gave rise to a kind of hybrid that accommodates both the Chinese tradition and European observations as can be seen from a re-examination of all the star-maps that they produced in this period. In fact, such a strategy had already been taken by the Muslim astronomers in the *Huihui lifa* 回回曆法, the *Chinese-Islamic System of Calendrical Astronomy* complied in the beginning of the Ming dynasty in the 14th century. The difference, however, is that the Jesuit astronomers carried out their work in a way that was much more systematic and thorough.

Symposium The politics of radiation protection - ID 234

Contribution ID: 253

Technologies and atomic knowledge for a history of radiation in Spain in the 1960s

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When the Spanish government authorized a Spanish electrical company to build the first nuclear power station in 1962, a significant change was ushered into the history of Spanish radiation protection. Until then, atomic research in Spain had been placed in a state organization – the Spanish Nuclear Energy Board – under strict control of the Franco government. Although this organism had set up some pilot facilities, the political decision to produce nuclear-based electrical energy in Spain opened a new space for safety and radiation protection.
With the purchase of the first power reactor from the North American company Westinghouse in 1964, new atomic practices and knowledge arrived in Spain, as did different ways of organizing and managing

the industry and also regulations, up to then unheard of in Spain, such as those from the US AEC and the IAEA.
I propose to analyse the history of knowledge, regulations and experimental practices that were developed on safety and radiation protection in the experimental space that the *Zorita* nuclear power station (1967) was. Where knowledge and practices were, I suggest, conditioned by political, economic, industrial and social factors, and in addition to engineers and researchers, other professionals participated who contributed knowledge that was equally as expert.
The variety of material conserved in the TECNATOM Historic Archives, the engineering company that coordinated construction of the power station, will be the main source for this work, whose objective is to expand the narrations on the history of radiation protection in Spain.

Contribution ID: 785

The Eastern bloc countries and the International Atomic Energy Agency: knowledge transfer and radiation protection

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This paper focuses on the role of the International Atomic Energy Agency in knowledge production in the field of radiation protection in the countries-participants to the Council for Mutual Economic Assistance. The CMEA was a multilateral organization, established as the socialist bloc's response to the Marshall Plan in 1949, and its members used IAEA safety and health measures to develop their own standards already in the 1960s. In the late 1960s, the IAEA started a series of discussions with the CMEA concerning the closer cooperation on information exchange, and eventually, they signed a formal agreement in September 1975. This paper investigates the development of radiation safety measures, standardization of instruments, radiation protection terminology, and technical vocabulary that took place at the CMEA countries. Through the analysis of the early connections and activities that existed between the IAEA and the CMEA members including scientific-technical cooperation in radiation protection and transfer of knowledge and experts, one unfolds the story that led to their agreement on cooperation and to more open exchanges in the 1970s. The paper takes a closer look at the actors from both sides of the Iron Curtain – technical experts, nuclear scientists, diplomats, and others who were involved in the circulation of knowledge and practices. By focusing on the CMEA-countries the paper explores the levels of freedom for actors in these countries vis-a-vis the USSR in dealing with the IAEA. It further questions how this corresponded with the level of secretiveness in the area of radiation knowledge in the USSR.

Contribution ID: 787

How the United Nations conceived nuclear rights

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The United Nations is considered a protector of universal human rights. Yet, UN agencies circumscribed the boundaries of individual human rights while expanding national nuclear rights. UNESCO in 1955

articulated this expansion as individual human rights to nuclear medicine, education and energy. By the 1968 Nonproliferation Treaty, signing nations were granted an "inalienable right" to develop nuclear technology when they agreed to forego producing nuclear weapons.
This paper will show IAEA hegemony in the field of radiation health safety regulations ensured human protection from radiation was eclipsed by national nuclear rights. The IAEA maintained the US Atomic Energy Commission's hegemonic view of radiation danger as inconsequential to many other concerns. Claims of the human right to not be contaminated by other UN agencies such as WHO were eventually trumped by the IAEA. Despite US Congressional investigations into the US AEC's handling of radiation dangers, the IAEA adopted the AEC motif with a discredited threshold model intact. This resulted in easy to standardize national regulations put in place by IAEA and WHO technical experts with their access to the levers of national legislative power.
The IAEA dictated the terms of nuclear global expansion. They adopted many of the US AEC tactics of vertical control of radiation using classified AEC data, exclusion of participants in scientific meetings and infighting with other UN agencies. Exploring IAEA management and their rhetorical use of human rights is important for a more accurate view of the UN, Cold War history and human rights.

Contribution ID: 940

The introduction of radiation protection rules in postwar Greece through IAEA fellowships

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"Neither Americans were advanced in health physics back then. An employee working with the reactor showed us that by placing his hand inside a hole of the reactor would cause a reflection of protons and neutrons. Imagine; By placing his hand!" With these words, Laodamas Sklavenitis, the Greek scientist who set up the field of Health Physics in the Greek Atomic Energy Commission, described his experience from his visit to the largest American laboratories in the late 50's. Although the scientific relations between Greece and the USA were based on the provision of fellowships and Technical Assistance, little importance was given to the field of radiation protection in the early post-war years. At the same time, the expansion of the use of radioisotopes created the need for a series of regulations for their safe use by citizens, hospitals, and laboratories. The International Atomic Energy Agency took advantage of this situation to consolidate its position as the main regulatory institution in the field of radiation protection. One of the main instruments used to accomplish its goal was to design a fellowship program allowing young scientists from Member States to get trained in major nuclear laboratories in other countries. This paper argues that the IAEA fellowship program worked as the tool through which young physicists – fellows would transfer the material culture learnt. Last but not least, participants aligned with the Agency in drawing up the Greek legal framework in the field of radiation protection, which until then it was completely absent.

Session XVI (Part 5/5) - Medicine

Contribution ID: 1243

The 1954 Flood, Sanitation Campaign, and the Re-Making of Medical Infrastructure in Early Communist China

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The 1954 Yangzi River flood was the first major natural disaster that occurred after the establishment of the communist region in 1949. Hubei province was the most heavily devastated place, in which more than 1.5 million hectares of land were submerged by floodwater and about 10 million local residents underwent survival crisis. In addition to the building of dikes and the recovery of production, local government initiated a massive sanitation campaign to maintain public hygiene and prevent epidemic outbreak in disaster-stricken areas. By investigating local archives, newspapers, medical brochures, and personal memoirs, this paper uses the 1954 sanitation campaign as a case study to examine the transition of medical infrastructure from the Republican era to the early People's Republic. Lied at the nexus between the two periods, the campaign re-structured the medical network and pharmaceutical market with many flexibilities and complexities. As this paper shows, medical institutions and medical workers with different backgrounds were re-organized in varied forms to provide basic health service between urban and rural areas. In everyday practices of epidemic prevention and disease control, vaccine inoculation and modern nutrition knowledge were combined with folk prescriptions and herbal remedies. And the request of large number of medicinal materials expediated the re-construction of an applicable network for pharmaceutical transaction across the country. Ultimately, the campaign created a new form of medical infrastructure against the background of the flood, which laid the foundation of cooperative medical services 合作医疗服务 in the 1960s-70s.

Contribution ID: 1255

Histories of Healing: Traditional and Local Medicine in Times of Pandemic

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Traditional and local medicine and healing have largely been devalued in the biomedical understanding of health and disease. This approach fails to recognise that a population can be 'self-reliant' in its health care practices, a philosophy, and perspective that is held within non-Western health cultures such as the ancient tradition of Ayurveda. Among the unintended yet damaging consequences of Cartesian divides (traditional medicine/biomedicine, science/people), the overuse of drugs such as antibiotics and antimicrobial resistance (AMR) have become critical matters of public/global health agendas. The coronavirus pandemic demonstrates that biomedical disease control alone is insufficient when considering the overall health and wellbeing of a population. For example, in the absence of appropriate (health)care, dietary changes along with supplements from various medical traditions have not only emerged as effective cures and remedies for healing from (long) Covid; they have also become biopolitical tools to self-manage vulnerabilities and inequalities (i.e.healthcare, employment, and childcare in convalescence).
This paper engages with the history of local, traditional, and profane healing knowledge-practices as an alternative, collective, and sustainable health care approaches as well as biopolitical tools of individual responsibility. By focusing on how to build on and establish 'good relations' between 'giants' and 'dwarfs'

in the global history of healing, particularly regarding (1) local and traditional medicines and biomedicine and (2) lay and professional expertise, this paper addresses pluralistic ways of healing practices and methods in unequal and uncertain worlds.

Contribution ID: 1268

100 years since the discovery of insulin – giants and dwarfs who made it possible

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In 2021, the medical community celebrates the centenary of the insulin discovery. 1921 is the year when F. Banting and C. Best started their experiments of pancreatic duct ligation on dogs, in the lab of J. Macleod at the University of Toronto. Shortly after, with the help of J. Collip, they obtained a purified pancreatic extract ("isletin"), which was administered to several young patients with diabetes mellitus, improving significantly their clinical condition. The remarkable achievement was offset by the Nobel Prize (1923) which has been controversially debated throughout the century; this, because of undeniable previous contributions of scientists from both Europe and US who remained behind the curtains or were bypassed or ignored. Analyzing biographies of "giant" and "dwarf"-figures of the insulin story, in conjunction with political, social, geographical, ideological environment, a multitude of causes/criteria can explain such differences in the success of their science. This varies from playing his chance by flipping a coin or encountering important political/scientific figures, to the ideological context or the major impact of the World War I in Europe, which for instance blocked the research work of Zuelzer in Berlin or of Paulescu in Bucharest. For Langerhans, the discoverer of islets, the lack of a mentor, his fragile health and a failed marriage, despite an excellent political/social context, forced him to resign early from a promising career. Also, the spread of this fundamental discovery in the press and industry has contributed substantially to the impact and success of insulin creators.

Contribution ID: 1071

Calculating prodigies as evidence for phrenology in Europe

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In 1837, a ten-year-old Sicilian boy named Vito Mangiamele (1827-1897) was presented at the Académie des Sciences in Paris. He was the son of a shepherd who, despite having no formal education, had an extraordinary calculating gift. Learned societies had shown an interest in calculating prodigies since the eighteenth century, when the Royal Society examined the arithmetic wonder Jedediah Buxton (1707-1772). As with Mangiamele's case, their interest was in understanding the calculating methods of child prodigies and the abilities that supported them, but the children could not explain how they accomplished what they did. At the time of Mangiamele's presentation, the discipline of phrenology was used to try to identify the faculties that lay behind arithmetic wonders. Phrenology associated bumps on the skull with personality traits and abilities. According to Gall, there existed an "organ for numbers" that

he had observed in the busts of great mathematicians and in calculating boys like Zerah Colburn (1804-1839). Alexandre Dumoutier made a cast of Vito Mangiamele's skull, which is currently in exhibition at the Musée de l'Homme. The boy and his tutor undertook a tour through Spain, displaying his talent before other learned societies and achieving international celebrity status, while phrenologists continued to debate his case. This presentation will explore how out of the ordinary or abnormal subjects like calculating prodigies were used as evidence for phrenology, and how their fame and international mobility fueled the discussion in Europe during the decline of this contested discipline.

References:
Cubí i Soler, Marià. *Lecciones de frenolojía*. Barcelona: Hispania, 1853.
Marlin, D. Notice sur le jeune Vito Mangiamele. *Revue Belge*, 1840, 16: 189-200.
Renneville, Marc. *Le langage des crânes. Histoire de la phrénologie*. Paris: Sanofi-Synthélabo, 2000.
Scripture, Edward. Arithmetical prodigies. *American Journal of Psychology*, 1891, 4 (1): 1-59.

Symposium Institutions and science and technology in modern China ----new approaches (ISHEASTM) - ID 28

Contribution ID: 57

The Comité scientifique du Kiang-nan and the Catholic Critique of Evolutionism in Modern China

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The overwhelming success of evolutionism in modern China has been traced in detailed studies in Chinese, Japanese, and several Western languages. Less well known are attempts to prevent or obstruct this success and undermine core propositions supporting what quickly turned into a widely shared faith.
This paper will analyse one of the earliest and most sustained attempts to stall the growing tide of evolutionary thought, initiated by the French Jesuit *Comité scientifique du Kiang-nan* that was established in Shanghai in 1873. Founded to counter Protestant versions of natural theology designed to subvert key tenets of Catholic doctrine, the *Comité* developed a multi-pronged strategy to insert religious perspectives on various branches of the sciences that gained ground in the context of the Qing administration's reform efforts, and to defend their views against both conservative Chinese and competing religious opposition. Evolutionism soon turned into a key battleground in this struggle. My presentation will focus on the diverse attempts guided by the *Comité* to refute evolutionism. To this end, I will review both strategies of publication and display, focusing in particular on articles circulated in the Jesuit mission's periodicals and changing exhibitions in the Jesuit Musée Heude.

Session XIX (Part 3/4) - History of Physics

Contribution ID: 1134

Name, identity, and discipline formation: the development of Busseiron in Japan

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Naming and development of social identity, together with topical and methodological standards, are important components in discipline formation. In this talk, I will explore this point by looking at the term *Busseiron*, the study of properties of matter in Japanese, which became the label of a subdiscipline within physics during wartime. The etymological investigation of how this term evolved, the approach I employ here, articulates how name and identity interact in the discipline's formation.
Busseiron already appeared in textbooks as the translation of properties of matter right after the modernization of Japan. It had functioned as the category of scientific knowledge mainly in educational contexts since then, but in the 1940s it earned another status as a framework of scientific inquiry: a group of physicists chose this word as the label for their theoretical study on properties of matter with a statistical mechanical approach.
Their rivalry against other research fields, especially against particle physics, motivated them and helped to develop their identity as explorers of properties of matter, which was marked off by the shift in the meaning of *Busseiron*. While they started the dedicated colloquium and journal, *Busseiron Kenkyu*, the term came to be used also in wartime research. Once this label entered the physicists' discourse, it stuck and stabilized the disciplinary status of *Busseiron*. Shared experiences under the name of *Busseiron* in education, research, and social activity such as the movement to establish a dedicated institution bore a generation of physicists with a social identity in *Busseiron*.

Contribution ID: 1174

Physics in the field: expeditions and field stations in the 20th century

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The aim of this paper is to reflect on the role of spatiality in the history of physics. Starting from the fruitful but partial focus on the laboratory that has characterized the mainstream historiography of 20th century physics. It proposes to go beyond in order to illuminate other spaces of physics research that have been overshadowed. I propose a broad and more inclusive understanding of the spaces were physics knowledge was produced, by reconsidering the question: Have place, space, and geography been elements relevant for physics research practices in the 20th century? In particular, this paper interrogates how physics research was developed in the course of expeditions and the space of field stations in the 20th century, why physics research required and became intertwined with such field-based practices, for which purposes, and how physicists, research practices and instruments were adapted to field sites. Trough a conceptual and historiographical review, this paper seeks to add comprehensiveness and cohesion to the analytical and methodological tools that would guide a *history of physics in the field* and a *history of physics as a field science*. It also interrogates how the spatial turn can be brought to the core in the historiography of physics, what can result from such an exercise in terms of narratives and geographies of the discipline, and conversely, which contribution the history of physics can make to the spatial approach in the history of science at large

Contribution ID: 1260

Where Nobel Laureates and Nameless meet. The significance of "science for all" events to CERN's mission in the 1970s

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The European "big science" laboratory CERN has been bringing together physicists from all over the world since the mid-1950s. These researchers collaborate on prestigious cutting-edge physics, but rely on a huge number of support staff. Laboratory technicians, mechanics, guards, secretaries, and engineers make up 2/3 of CERN's workforce. Thus, this group of people is "giant" in numbers, but since they are rarely mentioned in historical studies, they are "dwarfs" in historiography.
Several studies on the social history of science have focused on the role of workers in the process of knowledge production and the genesis and documentation of results. The heuristic concept of "invisibility" is used to shed light on the activities of the large but underrepresented group of supporter and to illustrate the diversity and enormous scale of labor force in laboratories. The presentation goes a step further by discussing "invisibility" as a useful concept to highlight the role of internal educational activities that are not formally regulated but are nonetheless important to scientific practice, whether learning-by-doing, hands-on-learning, or informative conversations.
Drawing on archival sources (CERN & Swiss Federal Archives), I will consider the significance of the support staff's scientific knowledge to CERN's mission. "Science for all", an event regularly organized at CERN in the 1970s, in which top physicists presented their ideas and results to the interested staff, will explore the relevance of such events to the overall mission of a laboratory in the context of global scientific competition, but also in light of the local cultural environment.

Session XVII (Part 2/2) - Science and Philosophy

Contribution ID: 1158

Chien-Shiung Wu in Experimental Philosophy

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Chien-Shiung Wu was one of the most remarkable experimental physicists of the 20th century. With her 1956 experiment, violating the parity in weak interactions, she entered the forefront of American experimental physics. She was the first woman President of the American Physical Society, received prestigious prizes from the scientific community, as The Wolf Prize and The National Medal of Science, and worked on affirmative actions for women's rights. In addition to her legacy to nuclear physics and society, she contributed to discussions about quantum philosophy. At Columbia University, Wu and Leonard Kasday performed coincidence measurements to test Bell's inequalities using electron-positron annihilations and found evidence against local hidden-variable models. This talk focuses on Madame Wu's contributions to experimental philosophy and addresses how their experimental results were interpreted by considering quantum foundations debates.

Contribution ID: 1217

About the history of the development of quality methods: from the local approach to the global one

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Nonlinear problems were the subject of study from the outset of the emergence of exact natural science, but until the end of the XIX century the dominant position was occupied by the linear base model, and nonlinearity was considered by means of corrections. Such consideration meant a ***local*** approach, valid for small nonlinearities. In the XIX century the capabilities of traditional methods have been exhausted, so qualitative theory has been proposed, when the main attention is paid not to the solution as such, but to the qualitative characteristics of the system, its behavior and evolution. This meant a transition to a fundamentally different research strategy, for which attention is focused on the understanding of the system as a whole. The evolution of qualitative theory has been a complex and controversial process. At the initial stage, traditional approaches, the ideology of considering "in small" were clearly manifested. Crucial importance in the further progress of qualitative theory was the attraction of new areas of mathematics - topology and functional analysis. New research tools have been created based on ideas and methods associated with the names of many eminent mathematicians. Thus, the most important principle of qualitative theory - ***global*** consideration - was fully established. This led to the possibility of not only a general approach to the primary issues of a qualitative nature for a wide range of problems of nonlinear analysis but to a change in understanding and style of thinking in mathematics in general.
This work is supported by RFBR, project No 20-011-00402

Contribution ID: 1225
The turning points in the history of science of science

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The paper concerns the history of science of science, a research discipline slightly over one hundred years old. It indicates the turning points in this history in an international context, including:
- Poland 1910s–1939: the emergence of the thematic scope of a new research discipline and the formation of its terminology (S. Michalski, F. Znaniecki, M. Ossowska & S. Ossowski); the creation of specialized scientific journals: "Nauka Polska. Jej Potrzeby, Organizacja i Rozwój" ("Polish Science. Its Needs, Organization and Development", 1918) and "Organon" (1936); after WWII (under the influence of Marxism): the journal "Zagadnienia Naukoznawstwa" ("Problems of the Science of Science", 1965);
- the UK and the USA (from J.D. Bernal, E. Garfield & D.J.S. Price), the USSR, Germany, Hungary; the creation of journals: "Minerva. A Review of Science, Learning and Policy" (Germany, 1962), "Science Studies"/"Social Studies of Science" (USA, 1970; renamed 1975); the emergence of bibliometrics (1926–1969), scientometrics (1939–1969) and scholarly communication (1665–1970s); the creation of the scientific journal: "Scientometrics. An International Journal for all Quantitative Aspects of the Science of Science, Communication in Science and Science Policy" (Hungary, 1978);

- tools for "detecting and measuring" citations – abstracting and indexing databases (1963–2004): WoS (a current name), Scopus, GS;
- business publishing vs. "OA Movement" (1990s) and OJS (2001);
- DOI (2000), Crossref (2000) and ORCID (October 2012);
- abuses of bibliometric indicators vs. altmetrics (2010), DORA (2012), "Leiden Manifesto" (2015), "The Metric Tide" (2015) and "Responsible Research Metrics" (2016);
- China (in recent decades).

Contribution ID: 1114

Cooperation between dwarves and science giants to overcoming conceptual borders and build a scientific philosophy of sustainability

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This paper addresses the paradigmatic transformations of the philosophy of science developed in global south and its contributions to the construction of sustainable alternatives to solve the existing contradictions between industrial society and the environment. It has relevance for dealing with philosophical emergencies of science divided into conceptual borders, which are reflected in the way scientific knowledge and authorities develop in different socioeconomic contexts. Methodologically, contextualized analysis of studies on the socio-cultural character of the scientific method and discussions on the socio-political responsibility of science is used in pointing to the need for changes in the means of production in favor of sustainability in the face of resource scarcity challenges, global warming and destruction of the environment, as shown by the latest IPCC studies. Faced with the problem raised for discussion, science assumes social responsibility, from the moment that research on climate and scarcity of resources indicates that production models have contributed to this scenario. Faced with this context, the peoples of the global south, especially indigenous peoples, represent a source of knowledge necessary for science to develop solutions for a sustainable future based on the ancestral knowledge of these peoples.
Keywords: Science, Philosophy, Epistemology.
References
CAPRA, Fritjof. The mutation point. Science, society and emerging culture. São Paulo: Editions Cultrix, 1986.
MENESES, Maria Paula; SANTOS, Boaventura. (Orgs) Southern epistemologies. Coimbra: Almedina editions, 2009.
SANTOS, Boaventura Souza. Introduction to postmodern science. Rio de Janeiro: Graal Editions, 1989.

Symposium They Might Be Giants: Histories of Failed Science Diplomacy Initiatives (Commission on Science, Technology and Diplomacy) - ID 486

Contribution ID: 675

Digging in the dirt: uranium diplomacy, development, and the IAEA

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The foundation of the International Atomic Energy Agency in 1957 announced not only an institution charged with preventing the proliferation of nuclear weapons, but one meant to forge new diplomatic networks based on the peaceful uses of atomic technologies. In this way, as Gabrielle Hecht notes, the IAEA's charter endowed it with "high moral purpose." (Hecht, 2011) The front end of the nuclear fuel cycle was particularly significant for these new networks because uranium exploration and mining appeared particularly accessible to developing countries, and because development, a characteristic activity of the Cold War era (Frey, Kunkel & Unger, 2014), was viewed as a crucial diplomatic realm for the IAEA. This article uses materials from the IAEA archives to examine how the IAEA leadership aimed to promote uranium exploration and mining capabilities in its member states and in so doing increase its own centrality as a lynchpin international institution. The deed proved more difficult than it seemed: economics, politics, and the appearance of neo-colonial relations had the effect of dissuading countries of the Global South from integrating themselves into the IAEA perspective uranium network. Stated otherwise, even in overabundance, uranium maintained its geopolitical character, leaving developing countries skeptical that the investments involved in prospection and mining would ever be worth it. (Helmreich,1989; Adamson, 2020).

Contribution ID: 745

European technoscientific diplomacy and the Fukushima nuclear emergency. A diplomatic meltdown?

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Based on the testimony of the Portuguese ambassador in Tokyo, this paper addresses the way in which the European Union managed the Fukushima Daiichi nuclear accident *in situ*. The main questions we explore are the absence of a common response and how European countries used their experts in the face of a nuclear emergency situation.
Although the accident at the Fukushima nuclear power plant unfolds over time, in this paper we focus on the first "frames" of the disaster, i.e. when the water pumps of reactors 1, 2 and 3 stopped and the reactors began to overheat leading to meltdowns.
As no guidelines were issued for immediate action on the ground by the European Commission, there was no common action and each country used its technoscientific expertise in a different and unique way. In the case of Portugal, which has never had scientific attachés at its embassies, the official Japanese information was send to Portugal, analyzed by scientists and recommendations were sent back to Portugal's ambassador on a daily basis.
This case study calls for a discussion about the weaknesses and tensions in the European Union and the necessary corrections to be made to implement a common (technoscientific) diplomacy.

Contribution ID: 811

A "paper tiger" in science diplomacy? Scientific initiatives through SEATO, 1954-1977

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From 1954 the North Atlantic Treaty Organization (NATO)'s experiment for co-ordinated defence was replicated in Southeast Asia. Established in Manila and headquartered in Bangkok, the multilateral Southeast Asia Treaty Organization (SEATO) brought together Western powers (US, UK, France, New Zealand, Australia) with Asian countries (Philippines, Thailand and Pakistan) under the flagship of containing the spread of communism in the region. However, in contrast with its Western equivalent, SEATO folded in less than thirty years. Scholarly literature offers competing perspectives on the reasons for its lack of longevity, emphasizing its shortcomings as a military coalition (Buszyinski, 1981) and political entity (Franklin, 2006; Fenton, 2006). Yet, recent attention to "science diplomacy" has offered opportunities to re-think the history of multilateral organizations, including NATO, in light of their science initiatives (Turchetti, 2018). This paper extends this exploration by focussing on what made SEATO a "paper tiger" in South-Asian affairs. Did its failure as an alliance partly derive from lack of success in elaborating scientific collaboration schemes? Or was its failure *despite* these successes? What do these projects tell us about open and covert ambitions of science initiatives in Southeast Asia?

Relevant literature:

Leszek Buszynski, "SEATO: Why it Survived until 1977 and Why It Was Abolished," *Journal of Southeast Asian Studies*, 12 (1981): 287-296.
John K. Franklin, *The Hollow Pact: Pacific Security and the Southeast Asia Treaty Organization*, PhD Dissertation, Texas Christian University, 2006

Contribution ID: 863

On the Road to Stockholm: Prague Symposium on Problems Relating to Environment, 1971

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In May 1971, the Czechoslovak capital hosted the international conference on environment that brought together high-ranking official representatives (on ministerial level) and scientists from both sides of the Iron Curtain. The idea to organise such an event reflected Czechoslovak interest in environmental planning and was one of the main outcomes of the country's science diplomacy on the field of global environmentalism in late 1960s. Organized under the auspices of the United Nations Economic Commission for Europe, the meeting's aim was to become an important stepping stone in the process of formation of a new international institutional landscape related to the environment. UNECE with its history of facilitating international cooperation across the Iron Curtain provided an optimal platform for such an undertaking. Nonetheless, the significance and impact of the "Symposium on Problems Relating to Environment" was overshadowed by United Nations Conference on Human Environment and instrumentalized by Soviet international politics for its own aims associated with the Brezhnev doctrine. Soviet authorities considered the environment to be a purely domestic issue and did not show much

interest in pursuing international environmental cooperation. The 'German Question' in the UN served as a Soviet instrument to pursue Soviet interests and resulted in downgrading of the Prague meeting and subsequent boycott of the Stockholm conference by the entire Soviet bloc. Based on joint paper with Jíra Janáč (Centaurus, 2020).

Symposium Environmental change and energy systems - (ICOHTEC) - ID 123

Contribution ID: 140

"The latent heat of vaporization is totally lost": can solar energy be a risk for sustainability?

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Julio Hirschmann Recht, a professor in Chile, in 1960s evaluated the contribution of solar ponds for Potassium and Magnesium production from the Atacama Desert. Their description celebrates the relevance of this energy harvesting system. Nevertheless, Hirschmann wrote about energy losses. A more careful analysis, like the vision by him, integrates the thermodynamic process and it can demonstrate that not always solar energy technologies are environmentally friendly.
The performance of solar energy technologies usually is analyzed as a contribution to sustainability because the only variable considered is the oil or carbon save in so far as the calculation made with an economic classic perspective. An opposite vision, thanks to the ecological economy, allows describing the Human Appropriation of Net Natural Production.
The elaboration of by-products of Nitrates in the Atacama Desert is an excellent example of energy and matter exportation and circulation with a very big ecologic footprint but, also, reveals a less evident phenomenon as the change of hydric balance in the driest place in the world.
A discussion about Energy and Civilization, considering George Basalla and Vaclav Smil visions, among others, could be useful in order to strengthen an analysis about what kind of history of environment and technology we can offer to understand Intersected Scales in the complexity of the relationships between north and south hemispheres and trans-boundaries (Julia Thomas), crossed with the innovation thesis (David Edgerton), and demonstrates the complexity of using environmental history brings with it paradoxes and challenges us to study and inform critical issues.

Symposium The little people of "big science": the image of the ordinary scientist in late soviet culture - ID 537

Contribution ID: 838

Materialistic wizards: scientists in soviet science fiction

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Arthur Clarke's third law states: Any sufficiently advanced technology is indistinguishable from magic. Advances in space, nuclear power and cybernetics have made yesterday's fantasies real. What once could have seemed magic and magic has now gradually entered the lives of Soviet people and had materialistic foundations. The idea of transforming nature has been an important part of Bolshevik ideology since its inception, but it was in the late Soviet period that science opened up opportunities for previously unthinkable projects. Optimistic expectations made it possible to dream about how nuclear energy would melt the ice of the Arctic, or how trees would grow on Mars. Science became a universal tool with which anything could be done.
Numerous employees of the Soviet scientific institutions on the one hand were the readership of science fiction, although in the USSR this genre was perceived as children's literature, on the other hand, they saw themselves as heroes of science fiction works. It is indicative that one of the cult works of the Soviet science fiction "Monday begins on Saturday" is dedicated to the work of the Research Institute of Witchcraft and Magic, an organization in which science and magic are combined.
Analyzing the Soviet science fiction, we can clarify the place of science in the value system of late Soviet society. Special emphasis will be made on how the Soviet science fiction thought about the interaction of man and the environment.

Contribution ID: 842
American Images of the Soviet science in the Cold war (1950-1980s)

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International science is very competitive realm. Usually there is a great contestation over important theoretical and applied scientific issues among scholars and research institutes. In the cold war epoch there was an acute rivalry between American and Soviet science. Besides an eagerness to collaborate in some projects, the USA and USSR tended to beat each other in the various fields of science. This paper is devoted a representation of Soviet science in American press. The American newspapers and scientific journals discussed strengths and shortcomings of the Soviet science to understand the performance of their own national science. In general, experts distinguished several key features of Soviet science. They were: a) narrow outlook among ordinary researchers restricted to his specialty; b) computer technology in many aspects depended on imports of such technology from the capitalists countries; c) Soviet engineers had difficulty translating basic science into practical technology; d) Soviet scientists protected against criticism by their colleagues, which led to low quality of publications in the Soviet research journals; e) however, it was believed that Soviet science was more venturesome and imaginative than American in some fields (parapsychology, electromagnetic); f)Soviet labarotories appreciated very strong in laser and space research; g) experiments in climate and weather modification had been much more extensive in the USSR, than in the West.

Contribution ID: 869
Soviet Women and Big Science: Gender in Siberian Academy (1957-1980s).

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The foundation of Novosibirsk Akademgorodok in 1957 was experimental for two reasons. First of all in the sense of new science politics' model and the second as a new communist Utopian city of science. Soviet communists had contradictory relationships with scientific community. From the one hand their Marxist beliefs and Cold War needs for Big Science made them provide more and more ambitious scientific projects (especially in Nuclear Physics area). From the other their Marxist class "sociology" of science provided them political suspicions and in extreme cases led to something like lysenkoism. The question whom Soviet academic and science community consisted of is not trivial in this situation. In my paper I want to search the science model of Akademgorodok through the framework of gender. Soviet high rank academician almost in any cases was men but how this situation could combine with political demand of women representation in science.

Session XIX (Part 4/4) - History of Physics

Contribution ID: 1183

Diamilla Muller's early simultaneous magnetic observation efforts

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Demetrio Emilio Diamilla Muller (1826 - 1908) was a 19th century colourful character. Engineer, science populariser, newspaper editor, informal diplomat, convicted criminal and magnetic researcher Diamilla Muller managed throughout his life to be in contact with important contemporaneous politicians and scientists. Diamilla Muller showed a keen interest in studying a possible link between the observed terrestrial magnetic field effects and the Sun. In the 1870's Diamilla Muller organized what are likely the first worldwide informal networks of magnetic observation of short time scale events. In these he envisaged to study a terrestrial magnetic field dependence with either the Sun sky position either on a typical day or during a solar eclipse. At the time daily magnetic records were routinely made by observatories scattered throughout the world and if the correlation between solar activity and Earth's magnetic field was well established a proper physical explanation was still lacking. In fact open questions about the magnetic phenomena abounded while data collection without interpretation was the standard fare of many observatories.

In this paper we contextualise Diamilla Muller's efforts and results with coeval researches. Being a well connected outsider Diamilla Muller managed to harnessed the scientific community good will for his endeavours despite lacking an institucional position. The fact that his results were inconclusive coupled with overstated conclusions may explain why his endeavours are practically forgotten today.

Contribution ID: 1004

Britain's Atomic Energy Strategy towards Japan: The Anglo-American "Special Relationship", 1939-1959

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The Anglo–American "special relationship" was established in the early 20th century. It is called this because the two nations shared adversaries on "special" issues. As a result, Anglo–American relations created various scenarios in global relations.
During World War II, Britain and the US cooperated to develop atomic weapons that were subsequently used against Japan, while Japan also tried another method but failed. In the ensuing Cold War era, the two countries advanced peaceful uses of atomic energy for Japan to counter the Soviet Union through psychological warfare. The US Atomic Energy Peace Mission visited Japan in May 1955. However, the Japanese government altered its policy to solicit support from Britain because the US was falling behind in atomic energy development. A British nuclear reactor was used as the first commercial nuclear power station, in 1959, whereby Britain earned parity with the US in the context of nuclear power.
Research on Anglo–American and Japanese efforts pertaining to atomic energy during World War II, and use of a British-made reactor by Japan during the early Cold War has dealt with these issues separately. They have not previously been discussed in the same context from the perspective of the special Anglo–American relationship toward Japan that was altered by atomic energy strategies supported by post-war psychological warfare. This paper, considering the above issues in total, discusses the special Anglo–American relationship from 1939 to 1959 and its effects on atomic energy development in the US and Britain.

Contribution ID: 1264

How Europe chose not or wasn't able to become a Giant in human spaceflight

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2021 will mark the 60th anniversary since humankind ventured into the void of space beyond Earth atmosphere. After 60 years, marked by both international competition as well as international cooperation, human spaceflight is one of the most daring techno-scientific undertaking of humanity. Only 3 countries, worldwide possess, today, the capability of autonomously sending humans in space: US, Russia and more recently China.
Even though Europe, since the early 80s, both collectively and through individual Nations, has been a partner of major human spaceflight endeavours, it fell short of developing its autonomous human spaceflight capabilities. It was very close to do so in the 80s with the Hermes project.
The paper will present and discuss the European context, both among individual Countries, and in the broader context of the Cold War and its aftermath.
Human spaceflight is eminently an attribute of national power and has also become a diplomatic tool and an element of soft power. It does require a strong political will, ingenuity and resources. Europe managed to catch up with other space fairing Nations in nearly all domain of space activities by pooling the resources and expertise of many Nations. Some attempts were made to develop an autonomous human spaceflight capability (Hermes).
The paper will briefly present the political history of Europe's reception of the US Moon Landing in 1969, the efforts to develop a cooperative endeavour to position Europe among the space fairing powers including the debates and discussions among European countries to whether and how develop an autonomous European human spaceflight capabilities while the first European astronauts were flying both with the US and the Soviet Union.

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Contribution ID: 423

The Vatican observatory historical collections: a different perspective on the connection between science and religion

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This presentation offers a different perspective on the connection between science and religion in the Catholic Church, traditionally accused to be opposed to science because of the Galileo affair. In fact the Catholic Church had an important role in commissioning and disseminating science, especially astronomy: many astronomical institutions were established with the financial support of the Popes, and a well-known important calendar reform was due to Gregory XIII. The Vatican Observatory preserves a collection of historical instruments that illustrates both the scientific activity carried out in this institution and the role of the Popes in supporting the scientific research. In some sense, this is a case of religion at the service of science.

Contribution ID: 366

The great meridian circle of Reichenbach and Ertel in Tartu Observatory

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The most famous of the Tartu Observatory instruments is probably the large Fraunhofer refractor. Its modern meridian circle, made in the workshops of Reichenbach and Ertel in Munich, has received much less attention, but was also one of the largest of its kind at the time. In my presentation I would like to bring the instrument out of the shadow of more famous refractor. Struve placed an order to Reichenbach in a letter from July 3, 1818, but after receiving an answer that the instrument could take an indefinite amount of time, he also wrote to Repsold in Hamburg. In Göttingen, Gauss had both the Reichenbach and Repsold meridian circles. Struve wanted similar, but bigger one, and Repsold replied that he would get it when he was ready to wait for a new splitting machine to be made that would allow the desired size to be scaled. Looks like Struve did not want to wait, and the order went to Reichenbach. However, the instrument did not reach Tartu until the autumn of 1822. Struve began to explore its possibilities. From October 26 to the end of 1822, he determined the coordinates of 795 binary stars discovered earlier that year. But after receiving the Fraunhofer refractor a few years later (1824), the meridian circle remained in the background. An assistant usually worked on it, and a book like The Great Fraunhofer Refractor never was written about this instrument. Perhaps the instrument nevertheless deserves it.

Contribution ID: 247
Instruments of the short-lived Tallinn Naval Observatory

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Tallinn Naval Observatory was reorganised in May 1919 from small meteorological station that was founded in February 1919 during the first months of the War of Estonian Independence (1918-1920). Observatory's main tasks were the prediction of weather, distribution of weather reports and charts and the correct time service, however the plans for the future observatory were much more ambitions. Over twenty individuals worked at the observatory during its short life. It borrowed and acquired a notable collection of meteorological and astronomical instruments (many of these came from amateurs). The Naval Observatory was disbanded after the end of the war because there already were an astronomical and a separate meteorological observatory both situated with Tartu and affiliated with the University of Tartu. Instruments not needed by the navy were distributed between the two observatories and many of those who served at the observatory as specialists found placements in Tartu. The presentation will try to analyse how the collection of instruments was assembled quickly and during war.

Contribution ID: 1105
E-POSTER Jacquard controversial invention between science and technology

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The French silk weaver Joseph Marie Jacquard (1752-1834), thanks to his improvements to automated weaving, greatly assisted the advent of data processing. Born in Lyon from a master weaver, he has been involved in looms from the very beginning. Jacquard built an improved loom, exhibited in 1801 at the Paris industrial exhibition, where two years later he began working for the Conservatoire des Arts et Métiers. A loom by Jacques de Vaucanson (1709-1782), deposited there, suggested various improvements in his own, which he gradually perfected to the final state. Jacquard's invention was an attachment that sat atop a loom: a series of cards with punched holes would rotated through the device. Each hole in the board corresponds with a specific hook on the loom, which acts as a command to raise or lower the hook. The position of the hook establishes the pattern of the raised and lowered threads, allowing fabrics to repeat complex patterns with high speed and precision.This was exactly the kind of system that the computer pioneer Charles Babbage (1791-1871) envisioned for his analytical engine, except that instead of printing patterns, his machine would perform mathematical operations. The silk weavers fiercely opposed the Jacquard loom introduction, fearing it would deprive them of their livelihood due to labor savings. However, the advantages of this loom ensured its general adoption, by 1812 a huge number of looms, around 11,000, were in use in France and the inventor was rewarded with a pension and royalty on each loom.

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