Session 1

PRIORITY CLAIMS IN THE PUBLISHED RECORD: THE ROLE OF PERIODICALS IN SCIENTIFIC DISPUTES, 1800-1900

Organizer: Julie McDougall-Waters

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The purpose of this session is to think more about claims to priority in the nineteenth century and, specifically, on the ways these were played out in the published record. Recent work has revealed that certain periodicals were utilised by different scientists in distinct fields in order to publicize their ownership of particular ideas and findings (Baldwin, 2013). This session also builds on the idea that scientific disputes were often settled less by the actual timescale of events (who did what first?) and more by the proof individuals possessed of their pioneering work. One of the questions addressed here is what role the printed word—in its various guises—has in arguments over provenance?

The four speakers in the session approach this topic using examples from a variety of fields of science. From Swedish and British chemists, to anatomists in Sweden and the German lands, and French and British physiologists, the session draws on what we know about the specialisation of science and the proliferation of periodicals in the nineteenth century. We aim to illuminate the different ways priority disputes were communicated and negotiated in different contexts through both society publications and in the new specialised scientific periodicals of the nineteenth century.

Session title: Priority claims in the published record: the role of periodicals in scientific disputes, 1800-1900

PRINTING PROOF OF PRIORITY: ANDERS RETZIUS, JAN PURKINJE, AND THE MICROSCOPIC ANATOMY OF TEETH, 1835-37

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Swedish comparative anatomist Anders Retzius lectured on the microscopic anatomy of teeth at the Royal Swedish Academy of Sciences in January 1836, thinking he presented an original observation: that teeth were traversed by minuscule tubes, whose shape and pattern varied in different species. But, when this lecture was published in the Academy's *Transactions* in 1837, Retzius had to acknowledge that he was, in fact, the third person to publish on the subject (Leeuwenhoek was the first, 1678, and Jan Purkinje the second, 1835). Retzius discusses the issue of priority in the article, revealing that he had showed his work on dental microscopy to fellow Academy members, and, more importantly, shared it with his friends Jan Purkinje and Johannes Müller in correspondence in 1835. Retzius also points to similarities and differences in the publications, claiming for himself greater accuracy and completeness, while granting the priority of "re-inventing" the tubules to Purkinje.

This paper examines the rhetoric of Retzius's arguments regarding priority and validation, taking his widely acclaimed work on teeth as a point of departure to discuss the changing modes of communicating scientific findings within European knowledge communities in the early nineteenth century. How did the rising status of scientific periodicals change the ways in which priority claims were adjudicated? What was the impact on the significance of other ways of sharing information, such as lectures, correspondence, and witnessing? How did Retzius's generation of empirically oriented medical scientists use print media to stake out claims to originality and authority?

Session title: Priority claims in the published record: the role of periodicals in scientific disputes, 1800-1900

MARKING SCIENTIFIC TERRITORY: THE ANNUAL REPORTS OF THE ROYAL SWEDISH ACADEMY OF SCIENCES, 1821-1848

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The focus of this paper is Jöns Jacob Berzelius, self-appointed arbiter of chemical excellence and priority through the Annual Reports of the Royal Swedish Academy of Sciences, published between 1826 and 1848, and widely translated. In this period, academies of science were still central to the career and reward structures of science: fostering careers through academic prizes and grants, and publishing their own journals and proceedings. As secretary of the Academy and an internationally renowned chemist, Berzelius initiated the Annual Reports and used them to strengthen his position as an authority in his field, as well as to revitalise the wilting Swedish Academy of Sciences. In his reports, Berzelius delivered both an account and a judgement of the scientific observations published during the past year, assigning merit as well as censure to his international colleagues. Building on a tradition of annual reports and proceedings of academies and other scientific institutions, as well as an emerging set of scientific journals, Berzelius launched his annual reports as a sort of abstract journal, including evaluations and verdicts in priority disputes (cf. McClellan 1985, de Solla Price 1986, Csiszar 2012, Topham 2013). Berzelius' achievements with his chemistry reports are in contrast to the much less successful reports on botany, written by his locally oriented colleague Wikström. Comparing Wikström and Berzelius reveals differences in their approach to mediating between national institutions and an international scientific community. More specifically, they highlight differences in the particular meaning of "priority" in botany and chemistry.

Session title: Priority claims in the published record: the role of periodicals in scientific disputes, 1800-1900

PRIORITY, PUBLISHING, AND PEDAGOGY IN EARLY NINETEENTH-CENTURY ANATOMY

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In the early nineteenth century, the physiologists Charles Bell and François Magendie engaged in a priority dispute over the discovery of the roots of motor and sensory nerves. The dispute, which lasted for the course of most of Bell's professional life, illuminated the ways in which early-nineteenth-century medical science was changing, particularly with respect to the relationships between teaching and various forms of publication. When Bell first wrote on the nerves in 1811, surgeon-anatomists ran small schools of anatomy in their homes, and through his own school, the Great Windmill Street School of Anatomy, Bell developed both a specialist and non-specialist audience for "his discovery." By the time Bell died in 1842, with the priority dispute still unresolved, medical science had changed. The laboratory and lecture theatre were beginning to become restricted or semi-restricted spaces available to expert scientists and their students. Meanwhile, medical science was disseminated through journals, a space proclaimed to be open and unrestricted for purposes of priority disputes. As this priority dispute reveals, the nineteenth-century rise of scientific experts and creation of disciplines and specialties, long recognized as hallmarks of modern science, occurred alongside, and sometimes by means of, a division of the spaces for science that had previously been united by their pedagogical purposes. Pedagogy lost pride of place, and the priority dispute was settled for history as much by those changing spaces of science and the rise of the journal as it was by work on the "discovery" itself.

Session title: Priority claims in the published record: the role of periodicals in scientific disputes, 1800-1900

EXPLOSIVE DISPUTES OVER CHEMICAL DETONATION: SPRENGEL VERSUS ABEL

Julie McDougall-Waters

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Hermann Sprengel (1834–1906) and Frederick Abel (1827–1902) were both chemists in London experimenting on explosive mixtures, in part for their safe use and storage by the British army. This paper, however, considers the distinction between Sprengel's and Abel's publishing activities and the impact on settling a priority dispute in the late nineteenth century. In 1893, the Royal Society of London received from Sprengel a paper in the form of a pamphlet, which outlined the contention that Abel was receiving undue praise for a chemical discovery, one that belonged to Sprengel. The source of Abel's transgression was a paper published in the Royal Society's publication, the *Philosophical Transactions*, in 1874. In this paper, Abel claimed that he and his assistant, E. O. Brown, had discovered a way to explode wet gun cotton using large amounts of a detonator such as mercuric fulminate. Sprengel's challenge to Abel's priority was that he had published a paper in the *Journal of the Chemical Society* in 1873, several months before Abel's, in which he demonstrated the method employed by Brown and Abel. In this paper I show that in evaluating the evidence the Royal Society was not simply concerned with who the originator of the method was but, rather, who was first to publicize their findings, and where. This paper provides an account of the dispute between these two chemists in order to draw attention to the different spaces Sprengel and Abel used to stake their claims to priority, and the consequences of doing so.

Session 2

SCIENCE IN FILM AND THE DEFICIT MODEL

Organizers: Fernando Vidal, Carlos Tabernerno Holgado

The historically narrow view of the public understanding of science, the “deficit model,” attributes negative public attitudes towards science to a lack of scientific knowledge. This model depicts the public as largely ignorant and expert-dependent, or as an empty bucket that needs to be filled up with scientific knowledge. In this perspective, popularization proceeds in two stages: firstly, scientists develop genuine knowledge; and then popularizers of various kinds disseminate it to the public in necessarily simplified, sometimes distorted, and at any rate impoverished yet digestible forms. In contrast, considering science and technology in the perspective of participatory models of knowledge production and management implies re-describing non-expert knowledge as qualitatively different from expert knowledge, rather than a debased version of it, and as an active factor in knowledge production and management. Nevertheless, the deficit model of science communication is still very much present in both scholarly and non-scholarly commentary surrounding science communication particularly regarding the popular medium of cinema. Under the deficit model, movies are viewed, at best, as an unreliable means of increasing knowledge, and, at worst, as a medium that significantly harms science literacy by disseminating misinformation. Concern about movies’ potential impact on science literacy has led to several recent formal initiatives by science advocacy organizations who hope to improve the accuracy of movie science including the U.S. National Academy of Sciences' Science and Entertainment Exchange and the Wellcome Trust’s Screenwriting Prize. Yet, much of the thinking behind these programs still revolves around a deficit approach focusing on notions of scientific “accuracy” in movies. The papers in this session seek to redress this continued reliance on the deficit model by examining the historic and contemporary interactions of cinema and science in order to show how cinematographic practices and discourses are constitutive of knowledge production and management in contemporary societies.

Session title: Science in Film and the Deficit Model

MOVIE CENSORSHIP, SCIENCE COMMUNICATION AND THE DEFICIT MODEL

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Abstract

From 1930 to 1968 movie studios sent their screenplays to various censorship groups in the U.S. and U.K. These censorship organizations, including Hollywood's official censorship body the Production Code Administration, the Catholic Church's Legion of Decency and the British Board of Film Censors, made sure that these scripts met the moral standards of religious groups who were concerned about the impact of movies on the public. The main concern of these groups was over explicit sex, violence and obscene language, but censor boards also dictated to studios which aspects of science they considered appropriate for movies and which scientific subjects they considered indecent or immoral.

In this paper I will explore the parallels between movie censorship and the continuing role the deficit model plays in contemporary science communication. The deficit model and movie censorship both reveal a lack of trust in the public by trying to remove ambiguity from audience interpretation. The foundation of the deficit model is a belief that if scientists can control messages about science then they can compel people to think the "right way" about scientific controversies. Movie censors mirrored this belief, by acting as gatekeepers who only permitted what they saw as "acceptable" narratives about science to reach the screen. Just as contemporary scientists often dismiss alternative narratives being told about science by an "ignorant" public, movie censors showed a lack of trust in what they perceived of as the "uneducated" masses. Censors wanted to "guide" audiences who they feared would not always remember that what they were seeing on movie screens were just stories. Specific examples for this paper will come from the archives of censorship organizations regarding specific movies including *Island of Lost Souls* (1933), *Dr. Ehrlich's Magic Bullet* (1940), *Night of the Demon* (1957) and *The Last Man on Earth* (1964).

Session title: Science in Film and the Deficit Model

ALTERNATIVES TO THE EXPOSITORY SCIENCE DOCUMENTARY

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Abstract

As a mass medium, film is an inherently one-way form of communication. The typically high costs of production together with the limited scope for audience participation afforded by the completed form of the filmic text, preclude the interactive or dialogical communication that is called for by those critiquing the deficit model of science communication. In addition, the prominent role of the expository mode in the history of documentary film – in which the truth-telling function of film is highlighted and, in its modern form, public witness is subordinated to expert testimony – would seem to align documentary with the top-down approach of the deficit model.

Science documentaries on television would seem to affirm this view of the limited communicative potential of film. Scientists appear as enthused presenters or expert talking heads, sharing their understanding of the world in simplified terms, all packaged with high-gloss visuals and unsubtle narratives in order to make the material attractive to the audience. The form of the television documentary, with its emphasis on entertaining explanation, thus inevitably invites charges of oversimplification and inaccuracy.

Yet in recent years the documentary revival in cinema has seen several documentaries which tackle scientific issues in a more open and contextualised way. Films such as Partricio Guzmán's *Nostalgia for the Light*, Werner Herzog's *Encounters at the End of the World* and James Marsh's *Project Nim*, in their different ways, all adopt an open form, whether contemplative or interrogative, that is able to engender a different range of responses. This talk will contrast cinematographic documentary practice with the norms of television practice in order to explore both the ways in which a deficit model can become implicitly embedded in filmic practice and the ways in which this can be transcended.

Session title: Science in Film and the Deficit Model

THE CHANGING NATURE OF MODERNIZATION DISCOURSES IN DOCUMENTARY FILMS PRODUCED DURING FRANCO'S REGIME IN SPAIN

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Abstract

Franco's fascist regime in Spain (1939-1975) offers the possibility of exploring the complex relationship between media communication practices and the processes of production, circulation and management of knowledge. The regime persistently used film and, later on, television as indoctrination and disciplining devices. These media served to shape the regime's own representations which relied, among others, on the generation of positive attitudes of adherence to the rulers through people's submission and obedience to experts.

Techno-scientific practices and discourses were key constituents of the regime's disciplining project. Documentary films were particularly apposite for realizing such project, insofar as they provided the necessary virtual witnessing of the viability and necessity of the situations and processes they depicted. Techno-scientific practices and discourses were approached mostly from a utilitarian perspective, and were shown as providing a theoretically neutral source of wealth, organization and improvement. The rhetoric of modernization they conveyed was addressed to supposedly ignorant, non-participant and submissive lay audiences, who should thus be helped with their most pressing everyday problems and needs.

This paper examines the changing nature of modernization discourses and practices as portrayed in documentaries produced during Franco's regime, and how the explicit deficit model of knowledge management they followed aimed at legitimating the regime's deeds and policies in its first decades. However, in the regime's last decade, as the relationship between experts and non-experts changed, despite their enduring legitimating aims, documentaries had to open out to the population's input both in epistemological and practical terms. Examples will include colonial-medical documentaries produced for the official newsreel in the 1940s and wildlife documentary films produced for television in the 1960s and 1970s.

Session 2

SCIENCE IN FILM AND THE DEFICIT MODEL

Organizers: Fernando Vidal, Carlos Tabernerno Holgado

The historically narrow view of the public understanding of science, the “deficit model,” attributes negative public attitudes towards science to a lack of scientific knowledge. This model depicts the public as largely ignorant and expert-dependent, or as an empty bucket that needs to be filled up with scientific knowledge. In this perspective, popularization proceeds in two stages: firstly, scientists develop genuine knowledge; and then popularizers of various kinds disseminate it to the public in necessarily simplified, sometimes distorted, and at any rate impoverished yet digestible forms. In contrast, considering science and technology in the perspective of participatory models of knowledge production and management implies re-describing non-expert knowledge as qualitatively different from expert knowledge, rather than a debased version of it, and as an active factor in knowledge production and management. Nevertheless, the deficit model of science communication is still very much present in both scholarly and non-scholarly commentary surrounding science communication particularly regarding the popular medium of cinema. Under the deficit model, movies are viewed, at best, as an unreliable means of increasing knowledge, and, at worst, as a medium that significantly harms science literacy by disseminating misinformation. Concern about movies’ potential impact on science literacy has led to several recent formal initiatives by science advocacy organizations who hope to improve the accuracy of movie science including the U.S. National Academy of Sciences' Science and Entertainment Exchange and the Wellcome Trust’s Screenwriting Prize. Yet, much of the thinking behind these programs still revolves around a deficit approach focusing on notions of scientific “accuracy” in movies. The papers in this session seek to redress this continued reliance on the deficit model by examining the historic and contemporary interactions of cinema and science in order to show how cinematographic practices and discourses are constitutive of knowledge production and management in contemporary societies.

Session 3

BEYOND THE ACADEMY: HISTORIES OF GENDER AND KNOWLEDGE

Organizers: Christine von Oertzen[1], Maria Rentetzi[2], Elizabeth Siegel Watkins[3]

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The proposed symposium examines overlooked agents and sites of knowledge production beyond the academy and venues of industry- and government-sponsored research. By using gender as a category of analysis, the papers presented uncover scientific practices taking place in locations such as the kitchen, the nursery, and the storefront. Because of historical gendered patterns of exclusion and culturally derived sensibilities the presenters demonstrate that significant contributions to science were made in unexpected places, often by women. The shift in focus to these different sites and different actors broadens the spectrum of what counts as science and where science happens. That is, in moving beyond the parameters of formal academic structures, this panel seeks to recast the ways in which the production of science itself is defined and to engage its audience in the redesign of the boundaries of our discipline.

Each of the proposed papers examines actors, practices, and flows of knowledge production in sites not tightly connected to learned societies, universities, or research institutes. These sites are understood as both literal and figurative spaces in which women and men engaged in the creation, dissemination, appropriation, and consumption of scientific knowledge. The papers cover the early modern to the modern period presenting case studies from North America, Western, Southern, and Eastern Europe.

The session is supported by the Commission of Women and Gender Studies of the IUHPS/ DHST

Session Title: Beyond the Academy: Histories of Gender and Knowledge (i)

WOMAN, KNOW THYSELF: PRODUCING AND USING PHRENOLOGICAL KNOWLEDGE IN NINETEENTH-CENTURY AMERICA

Carla Bittel

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In 1848, on the cover of the *American Phrenological Journal*, the firm of Fowlers and Wells instructed readers to turn the page and henceforth, "know thyself." Using this ancient Greek aphorism, phrenologists drew in men and women alike with the promise of understanding themselves and others. But phrenology had a particular appeal for many women, who saw it as a new opportunity to learn about the mind and body in the natural world. In antebellum America, as the industrial economy seemed to divide public and private, production and consumption, masculine and feminine, phrenology allowed women and men to stand within and between these binaries. White, middle-class women, in particular, used phrenology to affirm "true womanhood" and go beyond it at the same time. But as women sought information about who they were, many of them tried to designate who they were not, placing themselves high in moral, mental, and physical hierarchies, and demoting others. This paper explores the production and consumption of phrenological knowledge as theoretical and practical opportunities to negotiate gender. At a time when "science" itself had few boundaries, women became readers, consumers, proselytizers, and practitioners of this knowledge system. By encouraging followers to "know thyself," phrenology blurred the lines of expertise and the lines of gender, creating an interplay between users and producers. In these ways, phrenology allowed for women to venture beyond the bounds of womanhood, but not go too far off the path.

Session Title: Beyond the Academy: Histories of Gender and Knowledge

COLLECTING KNOWLEDGE FOR THE FAMILY: HOUSEHOLD RECIPE BOOKS IN EARLY MODERN ENGLAND

Elaine Leong

Max Planck Institute for the History of Science

When Mary Cholmeley married Henry Fairfax in 1627, nestled amongst the possessions she carried to her new home in Yorkshire was a leather-bound notebook filled with medical recipes. Over the next few decades, Mary and Henry Fairfax, their children and various members of the Fairfax and Cholmeley families continually entered new medical and culinary information into this 'treasury of health'. Consequently, as it stands now, the manuscript can be read both as a repository of household medical knowledge and as a family archive. Focusing on two Fairfax 'family books' and drawing upon a larger survey of over 150 seventeenth-century household recipe collections, this essay focuses on the process through which early modern recipe books were created. In particular, it explores the role of the family collective in compiling books of knowledge. In contrast to past studies where household recipe books have largely been described as the products of exclusively female endeavors, I argue that the majority of early modern recipe collections were created by family collectives working in collaboration across spatial, geographical and temporal boundaries. This new reading of early modern recipe books as testaments of the interests and needs of particular families encourages renewed examination of the role played by gender in transmission and production of knowledge in early modern households. Finally, my findings suggest that there may have been a difference between reading, writing, and collecting knowledge in closets and studies, and making and preparing in stillrooms and kitchens.

Session Title: Beyond the Academy: Histories of Gender and Knowledge (i)

SCIENCE FOR WOMEN IN THE SPANISH COUNTRY HOUSE (1780-1808)

Elena Serrano

Max Planck Institute for the History of Science

This paper focuses on the role of women in “Economic Agriculture” or “Rural Economy”, a broadly defined science that encompassed agricultural knowledge, botany, chemistry, healing practices, domestic economy, artisan skills, and rural architecture. Its aim is to explore in which ways women produced and circulated economical knowledge and shaped its practice, values, and public image.

Many scholars have reconstructed scientific practices in specific settings, from salons to the luxury Paris market. In the case of Madrid, public buildings such as the Hospital General or San Fernando manufacture have been studied. However, the hybrid aristocratic country-houses, half way between the public and the private, have not been studied as sites of Enlightenment production and circulation of knowledge in Spain. In tune with Madrid architectural changes, fashionable houses were built at the capital's outskirts that also aimed to meet Enlightenment ends of social utility. One of these was *El Capricho* (The Whim) owned by the Duchess of Osuna (1750-1834), the director of an outstanding female economic society, the *Junta de damas.*

Through comparison with other contemporary gardens, and drawing in the correspondence and biography of the Duchess, I will discuss what kind of knowledge and values did the garden displayed and how it embodied the role that upper class women were sought to play in society.

Recent contributions analyse how ideas about feminine nature influenced women’s actions in the Spanish public sphere. By setting my research against this background, I would like to explore how gender categories work to define and circulate agricultural knowledge and female social practices.

Session Title: Beyond the Academy: Histories of Gender and Knowledge (ii)

NATURE STUDY AND NATURE SPORTS: UNDERSTANDING FREDERIKE VAN UILDRICKS' MULTIPLE AUTHORSHIP AND OTHER EMANCIPATORY ACTIVITIES AT THE TURN OF THE 20TH CENTURY

Mineke Bosch

University of Groningen

This paper explores the life and work of the Dutch feminist and educator Frederike van Uildriks to ask historical questions about the connections between scientific enthusiasms and socio-political activism, about the constitution of the scientific realm at the turn of the century, and the role of women in this realm. It argues that the turn of the century world of science was much more diffuse and dynamic, and its scientific actors much more diverse and heterogeneous, than is often represented in the historiography. And, crucially, it was a world that involved women, particularly feminist women like van Uildriks whose intellectual interests spanned many fields, from botany to literary analysis and education reform. Through a close analysis of a recently discovered diary, Bosch contextualizes van Uildriks multiple authorship as well as her emancipatory life style within the emotional and intellectual economies of writing and publishing.

Session Title: Beyond the Academy: Histories of Gender and Knowledge (ii)

SCIENCE IN THE CRADLE: THE EARLY CHILDHOOD DEVELOPMENT STUDIES OF THE ASSOCIATION OF COLLEGIATE ALUMNAE, 1890-1910.

Christine von Oertzen

Max Planck Institute for the History of Science

As the nineteenth century drew to a close, the physiological and mental development of infants and toddlers was generating considerable scholarly enthusiasm, with men of science discovering in their own and others' offspring, to borrow Charles Darwin's phrase, "objects of natural history." Darwin's and his colleagues' interest was shared by a small number of American college-educated women, one of whom, Milicent Shinn, a graduate from the University of Berkeley, established an unprecedented network of at-home scientific observation that spanned the North American continent. At its core was arguably the most intimate element of late-Victorian domesticity, the baby in the cradle. My analysis of unpublished archival materials reveals that collective observation of babies, as practiced by Shinn's network of college-educated housewives and mothers, blurred distinctions between university and home, between expert and amateur. The most visible outcome of their enterprise was Shinn's highly praised study *The Development of the Senses in the First Three Years of Childhood* published in 1907. This history of infant scholarship encourages us to consider what else lies beyond the formal professional networks that have come to define our understanding of science itself.

Session Title: Beyond the Academy: Histories of Gender and Knowledge (ii)

"YOU WILL NOT OPERATE ON THAT CHILD!": LAY KNOWLEDGE AND FEMALE PROFESSIONS IN A MASCULINE WORLD OF POLIO

Dora Vargha

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As in many parts of the world, polio epidemics hit Hungary more severely than ever before in the 1950s. A disease that caused permanent disability in children in a time of heightened industrial production and increasing concern about population growth, polio became so important in the eyes of the Hungarian state by 1956, that Imre Nagy revolutionary prime minister took time during the most tumultuous days of the uprising to establish a polio hospital. A home away from home for years for thousands of children, polio wards and hospitals created a space where boundaries between medical authorities, family and medical staff, and scientific and lay knowledge were blurred. This site of medical and technological innovation, in the end, empowered women to gain scientific authority, propelled the rise of a new, feminine medical profession and equipped mothers to become depositories and challengers of medical knowledge in caring for their children with polio. Through the story of the Heine-Medin hospital in Hungary, based on analysis of medical literature, oral history interviews, and governmental and hospital documents, this paper argues that the specific treatment needs of polio contested scientific authority and the gender division of labor in medical practice. From the outside of the medical profession, mothers challenged male doctors and surgeons as they made decisions about their children's vaccination or treatment, based on lay knowledge that circulated among parents. From the inside, female physical therapists in polio hospitals fought the prestigious, masculine world of surgery – with success.

6th International Conference of the European Society for the History of Science, Lisbon, Portugal

Session Title: Beyond the Academy: Histories of Gender and Knowledge (ii)

‘ELEMENTARY PRINCIPLES’ AND ‘ORDINARY CLEANLINESS’: GENDER, CIVILIZATION, AND THE TRANSMISSION AND ADAPTATION OF BIOMEDICAL IDEAS IN COLONIAL UGANDA

Kathleen Vongsathorn

Max Planck Institute for the History of Science

Abstract

While women rarely appear in formal biomedical reports from Uganda, or indeed in biomedical reports from across Africa during the colonial period, biomedically trained women outnumbered men in most of Uganda’s medical institutions. Most of these women were missionaries, and carried primary responsibility both for the maintenance of medical institutions and for the biomedical education of Ugandans. This paper will discuss the spread and adaptation of biomedical knowledge in colonial Uganda, not in formal medical training schools, which a minority of the population had access to, but rather in informal settings.

Most Ugandans came into contact with biomedical knowledge through schools and attendance at hospitals, and the most widespread attempts to spread knowledge about science, health, and hygiene to all classes of Ugandans were through maternity and child welfare centers and women’s welfare work. Missionary women, the Ugandan women that they trained, and lady employees of the colonial government attempted to impart knowledge about such subjects as healthy child-rearing, nutrition, basic biomedical care, and hygiene through networks of home visits and occasional ante- and post-natal attendances at their rural welfare centers. This paper will explore the kinds of scientific knowledge that these women prioritized and attempted to spread; the moral and social agendas that shaped the selective transmission of scientific ideas; and the ways that knowledge was adapted by the Ugandan women, who picked different ideas piecemeal and incorporated them into their existing health practices and systems of knowledge. In so doing, it pays particular attention to the gender tensions and imbalances that surrounded biomedical education, when it was so often undertaken by women in a patriarchal society.

Session 3

FROM ECOLE POLYTECHNIQUE TO SECONDARY EDUCATION: CIRCULATION OF KNOWLEDGE ON DESCRIPTIVE GEOMETRY AND ITS TEACHING

Organizers: Evelyn Barbin, Marta Menghini

The development that had occurred in revolutionary France influenced the emergence of new mathematical subjects and their teaching, like descriptive geometry. Gaspard Monge, the author of *Géométrie descriptive* (1799), was strongly involved in elaborating the initial conception of the *École Polytechnique* and played a considerable role in its creation. The military and civilian needs of well-prepared engineers and administrators, which required the creation of the *École Polytechnique* and then the *École Centrale*, were common to many countries. The French *Écoles* influenced the expansion of studies of a technical nature in 19th century Europe, America and Africa.

This development contributed, in the second half of the 19th century, to the circulation of descriptive geometry, which appeared as the subject of technical or military schools “par excellence”. The teaching of descriptive geometry was introduced in “modern” or technical secondary schools, some years later. This was the case particularly in Germany and Italy, while in France the transfer went through the preparatory classes of Lycées.

This symposium wants to explore the circulation of knowledge which favored the transfers of the model of the École Polytechnique to other European and non European countries, and specially the transfer of relevant topics as descriptive geometry, from higher instruction to secondary schools. This is also linked to the debates on the training of the coming engineers and on the structure of technical education in the various countries. A first mean of communication among countries is the translation or adaptation of books, but a relevant role is played also by the journals and by correspondences.

Recently, many historical research concerned this subject in the context of one country, like in East Europa, England, France, Germany, Italy, USA, and it will be interesting to gather them in this symposium in order to better analyze the parallel developments and the links among them.

Session title: Symposium From the École Polytechnique to secondary education: circulation of knowledge on descriptive geometry and its teaching

FROM TREATISES TO TEXTBOOKS: THE CIRCULATION OF THE *DESCRIPTIVE GEOMETRY* OF OLIVIER AND OF HIS RIVALS

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Abstract

In the years 1830-1840, two *Treatises of descriptive geometry* were edited for the students of *École polytechnique*, the first one by Louis Lefébure de Fourcy (1830), who was an examiner, and the second one by Charles-François-Antoine Leroy (1837), who was a teacher of this School. Lefébure de Fourcy introduced a method of teaching which emphasized the notion of projection; the style of these treatises was, anyway, quite the same of Monge's, i.e. organized around a list of problems.

In 1843, Théodore Olivier wrote instead a *Cours de géométrie descriptive* that was explicitly conceived not as a treatise but as a textbook. Olivier was among the creators of the *École centrale des arts et métiers* and his book was devoted to students of this new School. Olivier's textbook was a subject of controversy in France, especially due to his "method of changes" introduced to facilitate the drawings of objects. It was criticized by Lefébure de Fourcy, and by Martelet in a note added to the fourth edition of Leroy's treatise. Nevertheless, the book was taken as a model by all the textbooks written for the candidates to the entrance of the Great schools edited in France, and Olivier's method was taught at all teaching levels in the course of the century.

We will examine the circulation and the inheritance of the three books in France and outside. Leroy's treatise was translated in Italian by Paolo Tucci (1838) and translated in German by E. F. Kauffmann (1853), while Olivier's textbook was quoted in the States by S. Edward Warren and was taken as a starting point by Albert E. Church in his *Elements of descriptive geometry* (1864).

Session title: Symposium From the École Polytechnique to secondary education: circulation of knowledge on descriptive geometry and its teaching

LUIGI CREMONA AND WILHELM FIEDLER: THE ROLE OF DESCRIPTIVE GEOMETRY IN TECHNICAL INSTRUCTION

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Abstract

The object of this talk is placed in the period of the Unification of Italy, in 1860s and 1870s, when the new country builds up its educational systems. Particularly the technical instruction is influenced by French and German models. We will explore the links between the work of Luigi Cremona and that of Wilhelm Fiedler in the field of descriptive geometry, analyzing the translations of their books, their papers, and their correspondence.

The book of descriptive geometry by Fiedler (1874), written for the Technische Hochschulen of Germany, was explicitly translated into Italian and adapted for use at secondary school level: in the Technical Institutes of the Italian Kingdom. In the same kind of school also Cremona's Projective Geometry (1871) was used. In turn, the book of Cremona was translated into German, French and English to be used in higher education. According to Fiedler, the main scope of the teaching of descriptive geometry is the scientific construction and development of "Raumanschauung". Fiedler reinforced this point of view in a paper translated and published in the Giornale di Matematiche. Like Cremona, Fiedler sees a symbiosis between descriptive and projective geometry. In the period 1822-1888 a correspondence between Fiedler and Cremona takes place, where Fiedler shows to be interested in Italian secondary Technical Education.

This talk will evidence the opinion that both geometers had about technical instruction at school and University level, their vision about the educational role of descriptive geometry, and the links with Monge's original conception.

Session title: Symposium From the École Polytechnique to secondary education: circulation of knowledge on descriptive geometry and its teaching

THE TEACHING OF DESCRIPTIVE GEOMETRY IN PORTUGAL

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Abstract

Portugal is one of those countries in which the influence of Monge's book *Géométrie descriptive* was felt already in the XIXth century.

This contribution will describe this influence, analyzing they way in which descriptive geometry was taught in Portuguese Universities and Polytechnic schools from 1885 to 1935. The beginning and the end of the analyzed period correspond to the publication in Portugal of two significant books of that branch of Geometry. In fact, 1885 is the year of the publication, of "Geometria descriptiva: illustrada com 47 figuras e contendo além do programma official do Curso Geral dos Lyceus muitas indicações adaptadas ao Curso da Escola Polytechnica". While 1931 is the year which saw the publication of the curriculum of Descriptive Geometry (and Stereotomy) of the University of Porto.

Session title: Symposium From the École Polytechnique to secondary education: circulation of knowledge on descriptive geometry and its teaching

THE EVOLVING RELEVANCE OF MONGEAN METHODS IN ADVANCED ARCHITECTURAL EDUCATION

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Abstract

The aim of this paper is to articulate the continued and evolving relevance of techniques of descriptive geometry codified by Gaspard Monge (1746-1818) in advanced architectural education. Historically, the deep imbrication of architecture, geometry, and techniques of representation has produced both the rational causes and practical means of formal innovation. The relatively recent rise and current predominance of the three-dimensional digital medium is having unprecedented effects on these relationships and their aesthetic outcomes. The architectural object and its representation are now coincident, manifested in the pixels of the computer monitor. Traditionally within the purview and skillset of the trained architect, the encapsulated knowledge of the projective techniques which allow this dynamic collapse is no longer explicitly deployed by the architect, but rather indirectly activated via software code.

Formal analysis of architectural precedents will trace the historical and theoretical lineages of orthographic and perspective projection, descriptive geometry, and contemporary trends in topological and computational design. Particular attention will be paid to precedents which demonstrate how variations of projective techniques have been used, intentionally or not, as generators of architectural form. Examples of pedagogical exercises used in the core architecture curriculum at the Harvard University Graduate School of Design will exhibit Mongean double projection as the proto-parametric antecedent of contemporary computational thinking and methods.

Session 5

1964–2014. *HOMMAGE* TO ALEXANDRE KOYRÉ. HYPOTHESES, PERSPECTIVES & POPULARIZATION WITHIN HISTORY OF SCIENCE

Organizers: R. Pisano[1], D. Drozdova[2]

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50 years have passed since the death of Alexander Koyré
(Taganrog, Russia, 1892 – Paris, France 1964).

Alexandre Koyré was one of the most influential historians of science of the 20th century and an eminent representative both of the Western European historical–epistemological tradition and (at that time) of the East Countries. Very notable were his impact on *The Structure of Scientific Revolutions* by Thomas Kuhn (1922–1996). It is evident his interest for the nature of scientific knowledge and of the role played by foundational concepts on the birth and development of modern science. Koyré has compounded historical arguments (i.e., the choice of the infinity in mathematics, "[...] *(a)* the destruction of the cosmos [...] and *(b)* the geometrization of space [...]", etc.) and philosophical issues (i.e., *extra–scientific nature* as part of the foundations of scientific theories). According to Koyré, 1) the history of scientific thought is never have been entirely separated by philosophical thought; 2) the history of scientific thought (e.g., for physical sciences) has not developed by *vacuum*, but it moves in a set of ideas, foundational principles, axiomatic evidences, which have usually been specifically considered belonging to philosophy and 3) the most important scientific revolutions are always state determinate by a replacement of philosophical speculations. As a result, Koyré assumed a *discontinuity* and consequently a *revolutionary* birth of modern science that had been previously challenged by Pierre Maurice Duhem (1861–1916) and his vision of *continuity* of scientific growth. Mainly we would like to discuss:

a) *Koyré's intellectual matrix and heritage encourage a reflection of the interdisciplinary field of philosophical history of science on its own history and self–identity.*
b) *The history of scientific thought cannot be entirely separate from epistemological philosophical thought.*
c) *Scientific revolution concept and the birth of modern science.* d) *Historical epistemology and philosophical categories of investigations.*

Session title: 1964–2014. Hommage to Alexandre Koyré. Hypotheses, Perspectives & Popularization within History of Science

KEPLER'S PHYSICAL ASTRONOMY: A SCHOLARLY TRADITION DATING BACK TO ALEXANDRE KOYRÉ

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Alexandre Koyré (1892–1964) gave crucial contributions to history of science, particularly to history of physics and astronomy. He underlined, within scientific (i.e, astronomical) revolution in the 17th century, the role played by Kepler's studies on the physical causes of the planetary movements. In the section of La Révolution astronomique: Copernic, Kepler, Borelli (1961) Koyré dedicates illuminating pages to the importance of the concept of force in Kepler and to the difference between a kinematical conception of astronomy and a dynamical one. Other scholars worked on Kepler's physical astronomy, and Koyré was probably the first one who devoted an entire section of such an important book as La Révolution astronomique to this subject. Based on our recent historical and epistemological works, at the ESHS 2014 we present the role assigned by Koyré to the beginning phases of physical astronomy inside his general conception of the scientific revolution. Finally, we will evaluate how Koyré influenced the research on Kepler's concept of force from the second half of the 20th century until now.

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Session title: 1964–2014. *Hommage* to Alexandre Koyré. Hypotheses, Perspectives & Popularization within History of Science

DIALECTIC OF THE INDIVIDUAL AND THE COLLECTIVE IN ALEXANDRE KOYRÉ'S ANALYSIS OF THE SCIENTIFIC REVOLUTION

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This talk aims to analyse the model of interaction of collective mental structures and individual creative efforts in the works of Alexander Koyré. In 1986 Yehuda Elkana made a claim that Koyré's historiographical approach was sociological by nature because he studied the changes in "images of knowledge" determined by the intellectual context (Elkana 1987). Later P. Zambelli enforced this claim by pointing to the influence that the ideas of Levy-Bruhl and Durkheim had on Koyré (Zambelli 1995). In fact, Koyré regarded the *Scientific Revolution* to be an intellectual revolution that had generated new mentality and new world-view (Koyré 1957). However the image of Koyré-"sociologist of knowledge" raises new questions. If he would intend to explore the changes in collective representations his choice to study the thinking of great minds looks inappropriate. In this talk we analyse the reasons of Koyré's interest in individual thinking. We argue that the interaction between the inherited *mental attitude* and the *individual mind* in the Koyré's scheme is not simple and linear. His historiographical conception presupposes that an individual is inscribed in an intellectual tradition based on which he produces and exhibits its work. But the individual is still able to break up with it and to create a new view of reality that can be persuasive for others.

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Session title: 1964–2014. *Hommage* to Alexandre Koyré. Hypotheses, Perspectives & Popularization within History of Science

GALILEO: THE ORIGINS OF THE SCIENTIFIC–TECHNOLOGICAL KNOWLEDGE

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Koyré analysis of the history of science from the philosophical point of view is a very representative example for students who study the philosophy of science and technology in the Russian universities to understand the historical epistemology approach. Special post graduate cource "History and philosophy of science" not only for philosophers and for all universities and research institutions in Russia intended for popularization of Koyre's though as post positivist methodology. A. Koyré: “The Cartesian and Galilean science has, of course, been of extreme importance for the engineer and the technician; ultimately it has produced a technical revolution. Yet it was created and developed neither by engineers nor technicians, but by theorists and philosophers”. Galileo was one of those who created this new science oriented to technical needs. He established the relation between scientific knowledge and the objects of practice. Galileo chose an approach unusual for scholastic science: technology began to lean on mathematical knowledge and models. At the same time he criticized the craftsmen's approach to technical activity that overlooked scientific knowledge and the laws in building machinery. He united the theoretical and the experimental proof, thus laying the groundwork not only for a new experimental science but also for modern engineering. This approach became possible because Galileo's new science had its roots in technical practice and was oriented to it. In his new science, Galileo manipulated natural objects like the present-day engineer. However, Galileo's new style of scientific-engineering and engineering-scientific thought and action manifested itself mainly in the sphere of thought rather than in practical activity. Galileo's works paved the way for the formation of engineering thinking and activity in practice as well as theory (RGNF-project 13-03-00190).

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Session 6

NETWORKS OF NATURAL KNOWLEDGE: SCIENTIFIC EXCHANGE IN BRITAIN'S MARITIME WORLD c.1750-1850

Organizer: Helen Cowie

Abstract

Recent work in the history of science has emphasised the communal and collaborative nature of natural knowledge and the crucial role played by go-betweens or intermediaries. Though often portrayed as the product of individual genius and heroism, the collation, analysis and transmission of information and objects often relied on a complex set of relationships and networks which facilitated their transfer. Friendship, sociability and personal contacts were vital to this process of exchange. Context and place were also important in explaining how specific forms of knowledge arose and how they were communicated to other localities. Building on this growing historiography, the papers in our panel focus on networks of natural history in the period c.1750-1850 and explore how botanical and zoological knowledge was transmitted between different places and groups. We consider the role played by physical objects in this process, from paper slips and letters to botanical specimens and live animals. We also emphasise the wide range of individuals involved in scientific exchange, including merchants, naval officers, travelling naturalists, diplomats and zoo keepers. Taken together, the papers highlight the global dimensions of scientific networks, which extended not only across the Atlantic, but into the Indian and Pacific Oceans, and were often activated from multiple centres. We examine the transfer of natural knowledge within and between empires and the social, scholarly and commercial networks that facilitated this.

Session title: Networks Of Natural Knowledge: Scientific Exchange In Britain's Maritime World C.1750-1850

COMMUNICATING LINNAEAN BOTANY: THE USE OF PAPER SLIPS

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Abstract

In 1752, the Swedish naturalist Carl Linnaeus (1707—1778) and his student Daniel Solander (1733—1782) catalogued Queen Lovisa Ulrika's cabinet of curiosities. The preparatory manuscript consisted in small slips of paper of standard size, which allowed both men to work on the collection simultaneously. The two naturalists later went on separately to use paper slips to record information on plants and animals. Linnaeus returned to standardised paper slips (closely resembling index cards) at the end of his career, in the late 1760s. This step he appeared to take somewhat reluctantly, when overwhelming pressures of work meant that he could no longer continue with his previous paper technologies, such as interleaved editions of his own works or loose sheet manuscripts. By contrast, paper slips highly suited his students who travelled the globe in search of new plants and animals. Hence, Solander embraced the practice of cataloguing organisms on paper slips earlier than his former mentor. In 1760, he moved to London and was hired to catalogue Sir Hans Sloane's collections at the British Museum, which he did using small paper slips. He continued to use these when travelling on Cook's voyage to the Pacific Ocean, and when cataloguing Joseph Banks's collections in the 1770s. Similarly, another of Linnaeus's student, Carl Peter Thunberg (1743—1828) was sent abroad by Linnaeus, to South Africa and Japan. Thunberg also used paper slips of a standard size.

That Linnaeus sent his students (or 'apostles') abroad with very precise instructions on how to collect and record the new species they found is well known. This paper will take a closer look at the little studied role of the paper slip in Linnaeus's students' geographical and botanical explorations. The paper slip not only ensured that Linnaeus's exacting standards were met, but had epistemological consequences.

Session title: Networks Of Natural Knowledge: Scientific Exchange In Britain's Maritime World C.1750-1850

ACCLIMATISING ANIMALS, EXCHANGING KNOWLEDGE: ALPACA NATURALISATION IN NINETEENTH-CENTURY BRITAIN

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Abstract

In 1811 the first alpaca to be exhibited in Britain was put on show at Edward Cross's menagerie in London. The animal was 'remarkably tame' and had 'perforations in its ears in which ornamental rings had been placed'. It soon proved a great favourite with the British public, who admired its 'playful manners' and expressed particular interest in its wool, which was thick, glossy and 'about eighteen inches long'.

The arrival of the alpaca in the years following Spanish American independence sparked interest in Britain in the possibility of naturalising the species and using its wool for textile manufacture. Over the next four decades these plans were put into effect as increasing numbers of alpaca were imported into Europe. Treatises were published on the subject of alpaca acclimatisation, some advising their naturalisation in Britain, others suggesting their introduction to the colonies, particularly Australia. A daring operation to smuggle alpacas out of Peru was conducted in 1858 by Charles Ledger, who succeeded in transporting 276 of the animals to New South Wales.

This paper examines attempts to naturalise the alpaca in the British Empire and situates these within the wider contexts of natural history, animal acclimatisation and commercial exchange. In the nineteenth century, Britain made concerted efforts to appropriate useful plants and animals and acclimatise them within its own colonies. Focusing on one notable example of 'economic zoology', the case of the alpaca, I study the networks of knowledge that facilitated the transfer of alpacas from one continent to another and consider how British subjects in places as diverse as Bradford, Liverpool, Sydney and Arequipa promoted and benefited from the naturalisation scheme. I emphasise the range of groups involved in the project, from Peruvian shepherds to British menagerists, positioning alpaca appropriation within a wider discourse of animal 'improvement' and imperial adventure.

Session title: Networks Of Natural Knowledge: Scientific Exchange In Britain's Maritime World C.1750-1850

'A YOUNG SLIP OF BOTANY': SOUTH ATLANTIC BOTANICAL NETWORKS AND BRITAIN'S ASIAN EMPIRE

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Abstract

By the beginning of the nineteenth century, the British presence in various parts of the South Atlantic and southern Indian Ocean encouraged increasing numbers of people to engage in scientific pursuits. This paper will demonstrate how various travellers, administrators and settlers based in the region established, nurtured and maintained connections with India, thereby drawing it more firmly into the orbit of what was rapidly becoming the jewel in Britain's imperial crown. John Barrow and Lady Anne Barnard at the Cape, William Burchell on St Helena, and Charles Telfair on Mauritius corresponded with, and sent collections to, friends and acquaintances around the world. But perhaps the region's most significant scientific connection was with India rather than London. Sir George Yonge, the second British civilian governor at the Cape, requested support from botanical gardens in the subcontinent. Conversely, botanists based there spent time at the Cape collecting specimens and conducting research. When William Roxburgh, the East India Company's botanist in the Carnatic and superintendent of the Calcutta Botanic Gardens was invalided home in 1797, he stopped off at the Cape to make a systematic collection of botanical specimens there and to procure supplies for the gardens under his supervision in India. In doing so, Roxburgh recognised the potential for the Cape to become a lynch-pin in Britain's botanical empire. These examples identify the region as an important locus of scientific activity in its own right, enmeshed in a web of connections spanning the globe and frequently circumventing London, at the notional metropolis of imperial science. In considering these issues, this paper will assess the impact of empire on science in general, and the ways in which the objectives and practices of botany in particular were inflected by changing political and strategic circumstances in the period.

Session 7

NATURE AT A GLANCE: THE CONTRIBUTION OF PORTUGUESE EXPEDITIONSTO A SCIENTIFIC APPROACH OF NATURE

Organizer: Ana Cristina Roque

Recent years have seen an increasing interest in biodiversity issues and in the management and exploitation of natural resources. Precise knowledge of these resources, their regional distribution and ways of harnessing has therefore constituted the object of specific study towards an assessment of the available resources, finding ways to help in its preservation and rational exploitation without prejudice to the secular forms of its use. Far from being a problem confined to particular areas, these issues have today a worldwide dimension, highlighting the deterioration or extinction of natural communities (plants and animals) and water resources, whose balance also affects the human communities. Given their global dimension, such issues need to be tackled from an inter-disciplinary perspective, combining different methodologies and branches of knowledge.

The specific research to make available the existent historical information on these topics provides the necessary framework for a wider perception of its evolution and changes as well as for a better comprehension of the present day situation.

Following these lines, this panel will address some early-modern Portuguese overseas expeditions, and discuss their contribution to a scientific understanding of the natural world. While focusing on how the information was collected and processed in order to integrate the European networks of circulation and communication of knowledge at the time, or on the impact of its diffusion in the scientific world, we expect to discuss the relevance of these expeditions to build a *corpus* of reference data towards a scientific knowledge of nature.

Session title: Nature at a Glance: The Contribution of Portuguese Expeditions to a Scientific Approach of Nature

NETWORKS OF EXOTIC NATURAL HISTORY IN EARLY MODERN EUROPE: WHERE DO OVERSEAS PORTUGUESE CONTRIBUTIONS STAND?

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Abstract

During the 16th and 17th centuries, exotic Nature was becoming part of everyday life. Naturalists, collectors, apothecaries, European royalty or common people showed interest in exotic fauna and flora for its applications or scientific worth, or because they worked as curiosities or natural wonders. News was spreading around European countries, encyclopedias were published, and the first cabinets of curiosities were created. For that purpose nets of connections were formed between people interested both in collecting and obtaining remains or information, in form of written texts or visual representations, of such an exotic or fantastic fauna. In the development of natural history as a discipline, collecting and observing nature become a widespread practice among an elite desirous to know Nature in all its forms. These two activities – collecting and the interrogation of nature – met in the studies of naturalists such as Aldronvadi, resulting in new attitudes toward nature, as a collectible entity, and generating new techniques of investigation that subsequently transformed natural history. They are also somehow patent in the works of Belon, Rondelet, Gesner, Coenen or Paré. Some of these naturalists worked only the available local knowledge of Nature while others incorporated the overseas and exotic accounts supported on their networks. Coenen, even though not being a scholar but rather a collector, included in his encyclopedias information from an exotic nature. This is true also in Aldrovandi's master tomes. Both authors refer to accounts of natural history given by Portuguese authors for Brazil or Africa. On the contrary, this is not the case in the pieces by Rondelet or Paré, even though they were also integrated in these types of networks of knowledge circulation. So, where do overseas Portuguese contributions stand? Where they part (or not) of these networks of exotic natural history in the early modern Europe?

Session title: Nature at a Glance: The Contribution of Portuguese Expeditions to a Scientific Approach of Nature

DESCRIPTIONS OF THE NATURAL WORLD BY PORTUGUESE NAVIGATORS FROM THE 15TH TO THE 18TH CENTURIES

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Abstract

The interest of men in Nature has always been present since Antiquity especially in Greek civilization. With the start of Discoveries, with oceans permanently crossed by all sort of travelers, news of the world were in constant movement. These travelers in more or less informal ways collected and exchanged information about Nature and the concern in comparing the new species found with the already known was a constant. The men who formed the crews of the Portuguese voyages of "Carreira da Índia" had no concern or knowledge of natural history that would allow them to describe the animals that they encountered along the route. However, daily references to natural elements, especially birds, are frequent in their logbooks and guides – the nature seen from a boat. The process of observation at sea is structurally very complicated and it is necessary to imagine what you do not see or see partially or briefly. When marine animals are observed, this observation is almost always partial and very elusive and is essential to make a mental reconstruction of the whole, which will also vary depending on the person who does it. More or less fanciful compositions that originated several stories about great sea monsters depended upon prior existing information about what could be found at the sea and the information contained in some classics begins to be questioned after these trips. We could say that the voyages of the Portuguese Discoveries allowed a new look and a renewed interest in Nature, which became widespread throughout society more open to novelty. Animals in ways never seen before were revealed and contact with these innovations prompted a reconsideration of the Nature and how this should be studied.

Session title: Nature at a Glance: The Contribution of Portuguese Expeditions to a Scientific Approach of Nature

COLLECTING "NATURAL OBJECTS" PORTUGUESE SCIENTIFIC EXPEDITIONS IN CABO VERDE ISLANDS AND MOZAMBIQUE IN THE XVIII CENTURY

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Abstract

Collecting "natural objects" was the main purpose of the scientific missions undertaken in Cabo Verde Islands and Mozambique in the scope of the 18th century's *Philosophical Expeditions* program and the organization of the *Real Gabinete de História Natural*, the embryo of a future Museum of Natural History, in Lisbon. Such missions should contribute to the knowledge of the "nature and natural productions" of these territories and give reasons for a new and scientific perception of nature.

However, some of them didn't achieve its objectives. Material and technical support, local difficulties and a small budget, limited the accomplishment of these missions. Though they didn't prevent the work of the "Naturalists" involved, they might have jeopardized some of the results. From the many samples collected some never arrived at Lisbon, such as the plant specimens Galvão da Silva sent from Mozambique, while others arrived but were not subject of study, like many of the geologic samples collected by João Feijó in Cabo Verde Islands.

To what extent do these circumstances compromised the results of these expeditions? In what form did they condition the real knowledge of these areas? Were there any alternatives of collecting information "on natural objects" outside this context? In what ways the action of residents, merchants and travelers, was crucial to the creation of a significant *corpus* of information on these territories?

Over the centuries, particularly from the 18th century on, several documents attest to this interest in observing nature and its forms of exploitation. This observation became fundamental for a global understanding of nature and the natural phenomena. By using some of these documents we intend to demonstrate the knowledge acquired about the flora, particularly the medicinal flora, highlighting simultaneously the present day scientific importance of recovering the historical information on this knowledge.

Session title: Nature at a Glance: The Contribution of Portuguese Expeditions to a Scientific Approach of Nature

MAPPING THE AGRICULTURAL RESOURCES OF CABO VERDE ARCHIPELAGO: THE ANDRÉIS REPORT (1780)

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Abstract

During the eighteenth century, there was a large increase in droughts and famines frequency and recurrence in the Cabo Verde archipelago, which resulted in higher levels of mortality and spreading throughout the islands. Facing this secular issue, the metropolitan authorities only reacted after the “great famine” of 1773-1775 that wiped out c. 40% of the population and the excruciating information of the governor-in-general Saldanha Lobo (1770-1776). Only then it was recognized that CaboVerde faced severe agricultural and agrarian problems that was necessary to know in detail. It didn´t existed local expertise to deal with such broad question and therefore colonial power used the occasional stay of the captain-engineer António Carlos Andréis to gather data and to systematize the local agricultural reality. Andréis report of 1780 will result on the first scientific approach to insular nature and to its agricultural issues.

Session 8

TRANSLATING SCIENCE

Organizer: Bettina Dietz

The aim of this session is to investigate the role played by translations in communicating, circulating and transforming scientific knowledge, within Europe as well as between Europe and other parts of the world. Although the history of science has so far shown only occasional interest in translations, it has already become clear that they cannot be reduced to the movement of scientific texts, ideas and concepts through space and time; in most cases they change these. Appropriation has been addressed as an active movement of assimilating scientific concepts and texts driven by the specific needs and interests of the receiving culture. Closely correlated with this is the interest in the role of translations within the framework of modernization processes. A third key question which crystallizes out of a number of studies asks about the specific local factors that shape the translation and reception of scientific texts in particular cultural and intellectual settings. The papers in this session will explore further dimensions of the translation of scientific texts. The topics and questions to be addressed include: Scientific translation as medium of intercultural communication; the transformative character of scientific translations and their various functions such as updating and correcting texts, simplifying, commenting and revising them; the analysis of various translational strategies and their specific consequences; and the translatability or untranslatability of scientific concepts, languages, and epistemic systems.

Session title: Translating Science

TRANSLATING LINNAEUS – REASSEMBLING THE 'SYSTEMA NATURAE'

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Abstract

This paper will address translations of Linnaeus' *Systema naturae* (1735) into various European languages as manifestations of a mode of publication that was widely used in eighteenth-century botany. Large publications, especially Linnaeus' own systematic works, such as the *Systema naturae* and the *Species plantarum*, were, as a rule, iterative in nature. This means that they were not intended to be definitive, but were from the start designed to be published in several editions as they required a constant process of supplementing, correcting, and updating.

The ambition and intention of most translators of Linnaeus' *Systema* was not only to make it accessible for practical botanical use by a wider readership, but also to supplement and correct it, and thus to shape it. Translations of the *Systema* therefore display different information profiles, specific to each target audience. The need to incorporate countless additions and corrections into an existing text, to document their provenance, to identify inconsistencies, and to refer to relevant observations, descriptions, and illustrations in the botanical literature all helped to develop and refine techniques of textual montage. Assembling the *Systema* became increasingly complex with each translation cycle. This shaped the external appearance of translations, and at the same time reflects the modular architecture of a botanical system designed for expansion.

Session title: Translating Science

THE USES OF HISTORY IN POPULARISING TECHNOLOGY IN LATE NINETEENTH-CENTURY JAPAN

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Abstract

Japan's late-nineteenth century drive to remake itself into a modern industrial state was accompanied by a push to create a scientifically and technologically-literate public, as befitted a modern nation. Popularisations of technical works were therefore particularly prevalent in the Meiji period (1868-1912) when Japan's industrial revolution was at its zenith. Crusading modernisers with an ideological axe to grind against Confucianism sought to recast civilisation from its traditional definition of moral order to one grounded in 'scientific rationalism'. Many such intellectuals therefore wrote and translated works in a paternalistic attempt to enlighten the country. Less ideologically motivated publishers, sensing a commercial opportunity, also created popular works. Many of these popularised books were initially specialist manuals aimed at British and American engineers, but were radically reconfigured in translation to make them accessible to their new readerships. Translators liberally removed from texts sections that they deemed superfluous. Such material typically included theoretical background and complex mathematical calculations. However, intriguingly, not only were historical narratives of technological inventions exempt from such purges, they were often expanded. Where translators considered the history in the source text inadequate, they would add information from their own knowledge, or supplement the text with translations of other works. This paper will consider how and why writers used history to frame technology, and how the inclusion of histories may have facilitated the spread of technical knowledge. The paper will also explore how the use of history changed as readers became increasingly familiar with many technologies.

Session title: Translating Science

TRANSLATION AS SCIENTIFIC COMMUNICATION: SWEDISH-GERMAN ENCOUNTERS DURING THE EIGHTEENTH CENTURY

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Abstract

During the eighteenth century Swedish scientists such as Linné, Polhem or Celsius contributed significantly to the development of natural history in Europe. Whereas their achievements reflect extraordinary scientific innovations in their own merit, their success also was closely linked to communication and medialization of scientific output. One of the primary channels for communication of Swedish science were the quarterly transactions , 'Handlingar', of the Swedish Royal Academy of Sciences (KVA, Kongl. Vetenskapsacademien, established in 1739). In line with the utilitarian zeitgeist, the 'Handlingar' were published in the vernacular language Swedish, since their normative aim was to promote agricultural and industrial development within the Swedish realm. However, the 'Handlingar' were soon identified as an attractive object for translation to other languages, in particular German.

Due to Swedish possession of a part of the Old German Empire, Swedish-Pomerania, the process of translating news from the KVA started in the educated press of the university town of Greifswald at the Baltic shore already during the early 1740s. Thus a foundation was laid for the development of translation of science for the German audience during the subsequent decades. The paper will present the development of translation as a form of independent scientific communication within the networks of Swedish and German scientists. In particular the genesis of the translation of the Japanese travelogue of botanist and physician Carl Peter Thunberg will be discussed as an example of these processes of mutual cultural encounters.

Session 9

RETHINKING MODES OF TEACHING AND TRANSMITTING KNOWLEDGE: A HISTORICAL PERSPECTIVE IN EAST AND WEST

Organizer: Zhu Yiwen

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How was knowledge taught and transmitted at different times of history? Many studies have already been carried out within single disciplines, offering valuable insights into the process of teaching and transmitting knowledge of each. However, bringing the studies together reveals a much more complex picture of how knowledge has been taught and transmitted in the past, and we find that the medium of the process has not received much attention. This symposium is going to deal with this issue from a different angle. By bringing together detailed studies from many domains of knowledge in the East and West, covering disciplines as different as mathematics, medicine, logic, astronomy and firearm technology, we aim to shape a structural analysis of possible distinctions and interactions between transmitters and recipients. Many important questions can be raised. Such as how many modes of teaching and transmitting knowledge can we observe through these studies? What were the differences among these modes? Did these differences arise from the peculiarities of different kinds of knowledge, or did they come from cultural differences, or other factors? Specifically, what kinds of media did different modes use: books or textbooks, translations, correspondences, almanacs, presentations, imitations or other practices? What were the relationships between different modes and different media? Furthermore what were the results and impacts of different modes? We hope our researches will contribute to these questions.

In a word, we focus on such a question: how and what makes the intellective commutation of cross-culture possible? Specifically, ZHU Yiwen will discuss teaching mathematical knowledge in two ways in history of China; JIANG Lu will talk about translating logical knowledge from West to China; PAN Dawei will focus on writing a medical book on the basis of West and Chinese medical knowledge; ZHENG Chen will discuss the transmitting of firearm knowledge in two ways in Ming and Qing Dynasty; WANG Xiaohu will speak of the transmitting of time system by almanacs in Ming Dynasty; ZHENG Fanglei will deal with the teaching of mathematical knowledge in 12^{th} century Europe; CHRISTINE Proust will focus on the teaching of mathematical knowledge in Old Babylonian Period. For all presentations, the media, relying on which the teaching or transmitting activities are able to carry on, and whether they are human practices: teaching or translating, or human products: books, canons or other things, shall be in the center of our symposium.

Session 9: Rethinking Modes of Teaching and Transmitting Knowledge: a Historical Perspective in East And West (i)

ACCEPTANCE OF INNOVATION WITHIN CHINA'S MEDICAL SOCIETY OF THE 1920S: ZHANG XICHUN AND THE READER

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The objective of this paper is to demonstrate the role of the emerging modernized communications in the transmission and acceptance of innovative ideas within China's medical society in the 1920s. Some works attempted to establish the legitimacy of the indigenous system of medicine in modern times, like the Records of Traditional Chinese Medicine in Combination with Western Medicine (Yixu Zhongzhong Canxi Lu醫學衷中參西錄), a handbook of integrating Western Ideas into Chinese

Medicine, by Zhang Xichun張錫純 (1860-1933), a Chinese doctor and educator who is recognized to be the most successful one. His work not only established the author's reputation but also had a

formative effect on Chinese modernization in medicine. Zhang's work evoked a great enthusiasm among his contemporaries: peers, critics and the average reader were all benefiting from much faster transmission of publications than pre-modern times, and the correspondence with the author has become available for the first time throughout Chinese history of medicine. Amazingly, the correspondence was published by Zhang as an extension of his work, which includes discussions and a variety of consultations and case reports of clinical application of Zhang's ideas from all over China. Thus, what was presented in the final version of the work became a text jointly accomplished by both Zhang and his contemporaries in the context of intensive interactions within the Chinese medical society guaranteed by modernized communications. Emphasis of this paper is placed on the readership Zhang had in mind by which the correspondence was achieved. Evidence suggests that the tension between the traditional authoritative model of pedagogy and modernized egalitarian author-reader interaction resulted in general misinterpretations of Zhang's innovative ideas of medicine.

Session 9: Rethinking Modes of Teaching and Transmitting Knowledge: a Historical Perspective in East And West (i)

TRANSFORMATION OF A LOGIC TEXTBOOK: THE CHINESE TRANSLATION OF THE COIMBRA COMMENTARY ON ARISTOTLE'S ORGANON

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Among Renaissance and Early Modern logic textbooks, the Commentarii in universam dialecticam Aristotelis (1606) edited by Jesuits of Coimbra enjoyed a most esteemed status throughout Europe. The Commentarii was brought to China by Jesuit missionaries and translated into Chinese by Francisco Furtado and by Li Zhizao. Their translation of the part on Isagoge and the Categories, retitled as The Investigations of the Patterns of Names, was put to print in 1631, presenting the earliest translation of Aristotelian logic into Chinese. The Ratio Studiorum (1599) prescribed that Jesuit professors were to teach the principles of logic "not by dictating but by discussing". Accordingly, textbooks like the Commentarii are structured in Quaestiones, i.e. disputed questions. However, the objective which was to be achieved by the logic training was clear: the ability and habit to observe "the laws of argumentation" and to follow the "proper order" of disputation. Yet in the Chinese translation the typical scholastic question which opens each treatise and proposes the subject of investigation was substituted by a summarising title. Subsequently, the character of investigation was transformed into a dictating one. However, questions printed as notes in the margins of the original version were integrated into the body text of the translation and followed by a short and concise answer. Furthermore, the typical scholastic structure of arguing which manifests itself in pro and contra and syllogisms became hard to detect in the translation. Thus, the text structure of reasoning was transformed into a structure of question and answer and a structure of "thus spake the master" and its corresponding pious exegesis which bear affinity both to catechism and Confucian classics. On the basis of comparing the Latin original with its Chinese adaption, my study shall explore possible reasons for this transformation.

Session 9: Rethinking Modes of Teaching and Transmitting Knowledge: a Historical Perspective in East And West (i)

TWO MODES OF TEACHING MATHEMATCIAL KNOWLEDGE IN 7th CENTURY CHINA AND ITS FAR-REACHING IMPACT IN 17th CENTURY CHINA

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How did ancients teach mathematics in China? Previous studies paid less attention to this issue, and furthermore some scattered studies strongly suggested that there was a single teaching culture of mathematics, which was based on the ten mathematics canons. My paper will challenge first this idea. According to my recent research, there were plenty of mathematical knowledge in Confucian canons, and therefore it existed at least two modes of teaching mathematics ancients in 7th century China. One mode lies in the use of mathematical canons, which we are familiar with, and another mode lies in the use of Confucian canons. I shall take Li Chunfeng李淳風 's commentary on the *Mathematical Procedures on Five Canons* (*Wujing Suanshu*五經筭術) and Jia Gongyan 賈公彥 (7th century scholar, a colleague of Li Chunfeng)'s commentary on the *Rites of Zhou Dynasty* (*Zhouli* 周禮), as two examples in order to reveal the ways in which they wrote textbooks: the two books were both used for Imperial Examinations科舉, and further they reveal the ways in which students learned mathematical knowledge. The two modes of teaching mathematical knowledge actually lay in two different and relevant cultures. The last part of my talk will focus on the *Rules of Arithmetic Common to Cultures* (*Tongwen Suanzhi* 同文筭指, 1613), which was based on *Epitome Arithmeticae Praticae*, edited and translated by Li Zhizao 李之藻 (1571-1630) and Matteo Ricci 利瑪竇 (1552-1610). How this book would appear in 17th century? This question can be answered by the structural analysis of the tension between two traditional modes of teaching mathematical knowledge and the tension between two corresponding cultures.

Session 9: Rethinking Modes of Teaching and Transmitting Knowledge: a Historical Perspective in East And West (ii)

HOW THE EUROPEAN FIREARMS WERE INDIGENIZED IN CHINA IN THE 16TH & 17TH CENTURIES

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The firearms of China experienced Europeanization in the 16th and the 17th centuries. This presentation reviewed three cases of the transmission of firearm technology. The muzzle loading light cannon *falcão* and breech loading swivel gun *Berço* were brought to China by armed Portuguese merchant vessels in the first half of 16th century. There are historical accounts which illustrate how the exotic firearms had been indigenized, evolved and changed, and how they inspired inventions in Ming dynasty. In the early 1620's, along with the introduction of cannons from Macao, a Chinese artillery handbook *Technology Supported by the God of Fire* (*Zhu Rong Zuoli* 祝融佐理) was compiled on the basis of Spanish sources. The text was useful for circulating ideas, although it was not as much as helpful in providing technical guidelines. The practice of making and manipulating firearms by Chinese artisans and adepts are discussed in this book. It shows an interesting phenomenon of interaction between different technical traditions and their development.

Session 9: Rethinking Modes of Teaching and Transmitting Knowledge: a Historical Perspective in East And West (ii)

"PEDAGOGICAL DEMONSTRATION" OR "DEMONSTRATIVE TEACHING" – THE BUYING HORSE PROBLEMS IN FIBONACCI'S *LIBER ABACI*

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Abstract

Fibonnaci's *Liber Abaci* is considered as one of the most important mathematical works in history both for its richness in mathematical knowledge and for its influence on medieval mathematics. What might not be known to many is the abundance of the ways in which Fibonacci exposed these mathematical contents. In this paper, I will focus on one of the ways usually adopted for the discussion of the problems concerning what we call indeterminate equations today. The example taken is a series of problems starting with "some people agree to buy a horse together in such a way that ….". By examining this example, we can suggest that Fibonnaci's goal is dual in writing these contents: he hoped that the reader would not only learn the general algorithm for solving problems of this type, but also be convinced that the algorithm yields correct answers. We can name this kind of discussion as "pedagogical demonstration" or "demonstrative teaching". From the point of view of mathematical proof of today, the general algorithm is achieved by incomplete induction, thus not by proof. Nevertheless, the analysis in this paper can enrich our understanding on mathematical teaching and proofs and the role of mathematical activity in the 12th century Europe.

Session 9: Rethinking Modes of Teaching and Transmitting Knowledge: a Historical Perspective in East And West (ii)

SOME FALSE EVIDENCE ON THE RELATIONSHIP BETWEEN MASTERS AND DISCIPLES IN CUNEIFORM MATHEMATICAL TEXTS

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Most of the known mathematical cuneiform texts were produced within the scribal schools that flourished in Ancient Near East in the early second millennium BCE (Old Babylonian period). This school context is documented by thousands of tablets containing elementary lexical and mathematical exercises. The very style of advanced mathematical texts evokes a didactic intention: for example, the first person is used in the statements and the second person in the procedures for solving problems. From these observations, historians generally deduce that the cuneiform mathematical texts are essentially "textbooks". This paper will rely on some examples to argue that this portrait is simplistic, and that complex motivations, which are not only (or even not at all) based on teaching, can be detected. This diversity of goals and uses of mathematical texts in Old Babylonian period will be illustrated through several examples. Some elementary mathematical exercises will be analyzed, in order to capture aspects of the relationship between young pupils and masters. Lists of problems organized as compilations, catalogues or collections, will be used to illustrate that the task of masters was also conservation of knowledge. And finally, it will be shown that some sophisticated texts, demanding a high mastering of mathematics and textual knowledge, were certainly not composed by masters for education purpose, but rather by erudite scholars for their peers. These diverse examples suggest that scribal schools were not only centers of teaching, but also conservatories of past tradition and intellectual centers for creation of new knowledge.

Session 9: Rethinking Modes of Teaching and Transmitting Knowledge: a Historical Perspective in East And West (ii)

THE FORM OF ALMANACS AND ITS IMPACT ON THE TRANSMISSION OF TIME INFROMATION

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In pre-modern China, each year people needed new almanacs compiled by the government. Almanac was the medium of releasing laws concerning time, year, month and day. This paper will reveal that the form of time was based on the specific characteristic of this medium, and had impact on the people's cognition of time. This phenomenon has a relationship with the form of writing of ancient Chinese people. Chinese traditional characters were written from up to down in a bamboo strip, and then from one right strip to its neighbouring left strip. The characters informing the reader about time within the table of almanacs were written in the order from right to left as well. People often focused on years which have special meanings for them, for example the year of their birth. Since they used almanacs almost their whole life long, they would find that the years with special meaning for them were moving from left to right in the table along with the time.

Session 10

THE SERVANT OF TWO MASTERS: BOTANISTS BETWEEN LAY AND ACADEMIC AUDIENCES

Organizer: Staffan Mueller-Wille

The relationship between scientists and the wider public has recently emerged at the forefront of research in history of science. The older historiography took little interest in the seemingly trivial process of 'science popularization,' in which scientific knowledge could only be simplified in a one-way communication process between scientists and passive non-professional audiences. More recent studies, however, profoundly altered our perspective by highlighting the reciprocal relations between a continuous construction of legitimate science and its 'other' – the lay public. The history of 19th century science has been at the forefront of this conceptual shift. Most studies in this area, however, have been focused on a limited range of national contexts, like Victorian Britain. As a result, we still have a poor understanding of the ways in which the construction of lay and academic audiences interacted in environments that strongly privileged state bureaucracies or colonial administration over various forms of voluntary associations.

The proposed symposium seeks to contribute to the debate on the interaction between science practitioners and the lay public in the long nineteenth century by focusing on a group of institutions that were sites of botanical research and at the same time had other important public functions, such as public instruction, dissemination of advanced agricultural practices, or entertainment. Striving to ensure smooth daily functioning of these multifaceted sites, practicing botanists had to persuade state bureaucracies, colonial authorities, or the elite public in the immediate utility of institutions under their care and, at the same time, assert their own status as legitimate practitioners of science. Contributors to the symposium will examine the fate of these multifaceted institutions as well as the social and academic status of their personnel as they related to the changing expectations concerning the nature of scientific research and the identity of a botanist. They will also consider the role of these practicing botanists in bringing about these changes.

Session title: The Servant of Two Masters: Botanists Between Lay and Professional Audiences

THE ROYAL BOTANICAL SOCIETY OF BELGIUM: A PLACE FOR BOTH PROS AND AMATEUR BOTANISTS (1862-1875)?

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Abstract

The Royal Botanical Society of Belgium was created in 1862 to bring together amateur botanists and to give them a place to meet and share information about Belgium flora with their professional counterparts. The Bulletin of the Society was, as a consequence, supposed to publish mainly greenhorns' notes and articles that the Royal Academy of Belgium would never have considered printing.

It did not take long, though, before « real » botanists took over the vast majority of the Society's "lay members". To these scientific notabilities and fledgling professionals the Bulletin's level was too low to promote their own career and to promote publication exchange with foreign institutions and societies. The State Botanic Garden itself used the Bulletin to enrich its library through exchanges. Therefore confirmed Belgian botanists badly needed to upgrade the level of the Bulletin by rejecting articles submitted by amateurs and by promoting papers about anatomy and physiology. Both disciplines were *per se* out of reach of the amateurs.

But, the professionalization of botany had not won, yet. Without the amateurs' fees the Society would never have survived and the Bulletin would never have been edited. Archives show that the scientific elites of the Society then felt the necessity to fashion some editorial strategies to keep the balance between hard-core science and more approachable papers that would please "lay members", or written by "lay members". Despite its original statutes, the Royal Botanical Society had thus become a place where lay and professional botanists ended up struggling for the same resources. This paper will depict how a private scientific society born in the wake of the "science bourgeoisie" faced the requirements of the emerging professional scientists, and how it managed to survive such an uneasy gap between hobbyists and confirmed botanists.

Session title: The Servant of Two Masters: Botanists Between Lay and Professional Audiences

PREDECESSOR OF VAVILOV INSTITUTE OF PLANT INDUSTRY – BUREAU OF APPLIED BOTANY

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Abstract

The Institute of Plant Industry (VIR) and its first director Nikolay Vavilov are among the most discussed topics in the history of Soviet science. However, the very name Vavilov and of VIR obscure the institution what was the basis for VIR: the Bureau for Applied Botany, as well as the head of the Bureau, Robert Regel. The scientific merits of the Bureau and of Regel were significant. In 1920, after Regel's death, Vavilov inherited the respectable institution with an established international reputation, staffed by more than 40 highly qualified employees. The Bureau owned several experimental stations and rich collections. On the basis of archival documents I will compare the directions in which Vavilov followed Regel's research and organizational plans, as well as show what a successful researcher and administrator Regel was.

One of Regel's techniques (and one that was also used by Vavilov) was that in all official reports prepared for the Government and the State Duma, he consistently put together the practical and "pure scientific" significance of research conducted by the Bureau. As a regular speaker in governmental and legislative commissions, Regel effectively defended the need for funding applied botany. Throughout the entire period he headed the Bureau, its research program developed consequentially. In the 1910s the Bureau of Applied Botany received 2/3 of the overall budget of the nine special Bureaus in the government agricultural administration. Regel's "official" notes are of interest both for the historian of scientific institutions and for the historian of ideas. For example, in the 1910s Regel was interested in the work of plant ecologists and sustainable land use as one of the Bureau's projects. He pinned great hopes on "applied plant ecology," a project that completely disappeared from VIR.

Session title: The servant of two masters: botanists between lay and academic audiences

ACCLIMATIZING RUSSIA: PLANT GEOGRAPHY AND AGRICULTURAL INNOVATION IN THE FIRST HALF OF THE NINETEENTH CENTURY

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Abstract

In the last few decades, the relations between plant geography, bioprospecting, and the rise of early modern and modern empires has been at the forefront of research in history of science. However, these studies have been almost exclusively focused on trans-continental, oceanic empires, while the territorial expansion of the Russian empire in the 18th - 19th centuries beyond its historic core to a different environmental zone of the Eurasian steppes has been largely neglected. In particular, the history of introduction of new agricultural and industrial crops to Russia in the nineteenth century remains unexplored, as well as the links between these projects and plant geography as an academic discipline.

The paper will focus on institutions, people and theories that shaped these acclimatization projects in the first half of the 19th century. In this way, we are going to redraw a familiar landscape of Russian 19th century science by shifting the focus of research away from the Academy of Sciences and universities to governmental agencies responsible for the promotion of agriculture and a state-run network of model farms, schools of horticulture and plant nurseries. We will explore social and epistemic identities of their personnel, these people's position within expanding ranks of Russian civil service, as well as their contacts with academic circles both in Russia and abroad. We will also examine the transfer of ideas about the spatial distribution of plants across the globe, as expounded by Humboldt, De Candolle and a few other Western European scholars of the period, to Russia, and analyze the interconnections between scientific ideas and specific initiatives aimed at the introduction of new agricultural plants to southern parts of the Russian empire.

Session title: The Servant of Two Masters: Botanists Between Lay and Professional Audiences

BOTANISTS IN CUBA BETWEEN LAY AND ACADEMIC AUDIENCES: THE HAVANA ROYAL ACADEMY OF SCIENCES, 1861-1898

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Abstract

This paper explores the contribution of botanist experts and botanist amateurs within the Havana Royal Academy of Medical Sciences, Physics and Natural Sciences (1861-1898), an association which united the scientific community in Cuba. In this case, I explore communication strategies and structures of argument employed by the botanist and naturalist in their attempts to define and legitimize their own practices when addressing different audiences.The Academy hosted the Herbarium by the Cuban-American botanist Adolfo Sauvalle from the collections created by his brother-in-law José Blain and the American naturalist Charles Wright. The Academy also witnessed the first scientific theoretical and experiment study in Cuba on an economic pest affecting coconut plantations, a locally important crop which initially highlighted figures such as the naturalist Carlos de la Torre y Huerta.

Session title: The Servant of Two Masters: Botanists Between Lay and Academic Audiences

THE BOTANICAL GARDEN OF BUITENZORG, 1817–1910: BETWEEN COLONIAL GOVERNANCE AND ACADEMIC IMPERIALISM

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Abstract

Between 1817 and 1868 the botanical garden of Buitenzorg had been one of several small organizations that supported the Dutch colonial government in trying to make money out of nature. When the Leiden academic botanist Melchior Treub took charge of garden in 1880, he continued a renovation agenda that had started in the late 1860s. Scientific journals were created, monographs were published, academic staff was hired and conferences in Europe were visited. The goal was to turn Buitenzorg into a central scientific institute in the Dutch Indies (which lacked a university) and to make it a magnet for international botany. Treub built a visitors' laboratory copying the famous zoological laboratory at Naples, tempting Germans, Austrians, Americans and Russians to come to Java.

However, the garden still had a 'non-academic' mission: it had to provide the colonial public with useful knowledge about the diverse plant cultures, it had to educate local planters and it had to import and export seeds. Treub did not abandon these missions.

In my paper I will not only show which social, political and communicative technologies Treub used to construct a new academic status for Buitenzorg, but also how he used this status to reach out to the sphere beyond the 'academic'. Treub did not feel that he had to balance between 'pure' and 'applied' science: he presented his institute as a longterm reservoir for *potential* useful knowledge, with academics in top positions. Next to spreading this gospel of total science, Treub appealed to the government, the agricultural elite, the Buitenzorg civil society by providing a social program for both the Dutch and native economies. He was able to secure a steady financial basis for his institute and to expand his institute: from 1904 onwards, Buitenzorg became the seat of the new colonial ministry of agriculture.

Session 11

THE FARM, THE LANDSCAPE AND THE LABORATORY: CIRCULATING KNOWLEDGE IN THE ATOMIC AGE

Organizer: María Jesús Santesmases

This symposium proposal aims at retrieving geographies and landscapes for the history of biology and biomedical practices. As *reinventions of nature*, the experimental objects the presentations talk about emphasize the field and the technologies of contemporary temporalities of scientific practices. These in turn involved border crossings and participated in the contruction of a biological research agenda throughout the atomic age. Not only agricultural practices and the farm, as agents, but also the interactions with laboratories played a part in historical reconstructions of knowledge and practices that flowed in and out, that circulated between indoors and outdoors to draw new lines, both epistemological and physical, of today's histories of living things.

Session title: The Farm, the Landscape and the Laboratory in the Atomic Age

AGRICULTURE AND MENDEL IN POST-REVOLUTIONARY MEXICO

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Abstract

During the 1930s and 1940s, two political tendencies that influenced research into plant genetics (with roots dating back to the *Porfiriato*) can be distinguished in Mexico's power circles. On one side were those who, as heirs of the Mexican Revolution, believed that farmer agriculture, based on a tradition of communal land-holding, had priority over the creation of new, successful agricultural practices. On the other side were those who thought that Mexican agriculture could only improve by becoming a large-scale private enterprise, far from socialist agrarianism. I will analyze the scientific conditions, and social and political relations that allowed the introduction and establishment of genetics in Mexico in the early 20th century, which was consolidated and institutionalized during the second half of that century. I will examine the effect that small communities had during the introduction of genetics in Mexico, emphasizing the main role played by two groups, that of engineer Edmundo Taboada and that of the Rockefeller Foundation, from the 1930s up until the late 1950s.

Session title: The Farm, the Landscape and the Laboratory in the Atomic Age

BIOLOGISTS IN CONFLICT: TRANSNATIONAL ORNITHOLOGY AND AGRICULTURAL DEVELOPMENT IN THE ANDALUSIAN MARSHES

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Abstract

By the end of 1936 it was becoming clear that the Spanish Civil War would not be easily resolved and securing resources became a priority for both armies in conflict. As traditional rice producing regions were under the control of the Republican Army, the so-called National rebels undertook to transform the Guadlaquivir marshes into a rice factory. In the immediate post-war period, the Francoist corporate state contributed to this endeavor by providing Guadalquivir planters with hybrid seeds obtained in Valencia.

The agricultural retooling of the Guadalquivir, together with reforestation projects and the eradication of malaria in the early 1950s, put the rich ecosystems South of the river into jeopardy. Soon, a group of Spanish and international scientists endeavored to create an agricultural station in Doñana through the collaboration of the World Wide Fund and the Spanish High Council for Scientific Research. Unsurprisingly, the projects of those scientists and engineers devoted to rice production and reforestation and those focusing on ecological studies collided. This paper traces their respective strategies to gain and retain political authority in a country marked by political authoritarianism and rapid economic development.

Session title: The farm, the landscape and the laboratory in the atomic age

ATOMIC LANDSCAPES: RADIOTRACERS IN ECOSYSTEMS AFTER WORLD WAR II

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Abstract

This talk explores the movement of radioisotopes through landscapes, and the consequences of these experiments and contaminations for ecology in the atomic age. Beginning in the 1940s, G. Evelyn Hutchinson and his collaborators began using radioisotopes to analyze the flow of materials and energy through ecosystems. This use of tracers in radioecology was inspired by the use of radioisotopes in metabolic biochemistry and physiology, and strongly supported the mid-century ascendance of ecosystems ecology. In addition, the US Atomic Energy Commission developed radioecology at three of its installations in the 1950s and 1960s: Hanford, Oak Ridge, and Savannah River. In these sites, radioactive waste itself provided tracers for ecological research, yielding information about the movement of materials through aquatic and terrestrial ecosystems. In the end, radioisotopes became “model pollutants” for developing means of detecting other environmental contaminants, especially synthetic chemicals.

Session title: The Farm, the Landscape and the Laboratory in the Atomic Age

CORN, CONSERVATION, AND THE COLD WAR: AMERICAN EFFORTS TO PRESERVE PLANT GENETIC DIVERSITY, 1940-1965

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Abstract

This paper considers the early history of American efforts to conserve for future use the genetic material of important plant species. It focuses in particular on how cold war politics and American agricultural needs, not environmental or ecological concerns, shaped the first institutions and programs dedicated to the long-term conservation of genetic diversity of plant species. In the 1940s, American agriculturists' loss of access to seed collections in both the People's Republic of China and Soviet Bloc countries helped to galvanize the creation of a national system for the collection and long-term storage of "plant germplasm" from around the world. At about the same time, a group of American maize researchers raised alarm about the potential for post-war international agricultural aid programs, through the introduction of mass-produced commercial varieties, to eliminate important reserves of genetic diversity in developing countries. They subsequently organized what was perhaps the first program to collect, catalogue, and preserve indefinitely the global genetic diversity of a single species: a pan-American effort to preserve corn varieties, sponsored by US foreign aid and technical assistance agencies concerned with political stability in Latin America. Both the US national plant germplasm system and the corn collection program would prove to be influential models for international plant genetic conservation efforts in subsequent decades.

Session title: The Farm, the Landscape and the Laboratory in the Atomic Age

CARRYING THE ANGOLAN SOILS TO THE METROPOLE: SCIENTIFIC PRACTICE, CIRCULATION AND CONTROVERSY IN THE DECOLONIZATION ERA

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Abstract

Inspired by Bruno Latour's chapter "Circulating Reference: Sampling the Soil in the Amazon Forest" (1999: 24-79), this paper intends to examine in detail the practices that produced information about the Angolan soils during the last decades of Portuguese colonial Empire, a period of rapid economic growth and State-sponsored Overseas Development Plans. It will follow the first campaigns of the Angolan Pedology Mission (created within the Overseas Research Board of the Ministry of the Overseas Provinces, in 1953), taking into account: 1) the preparation of the fieldwork in the metropole; 2) the logistics, procedures and routines in the colonial terrain – the observation, physical analysis of soil, sample collecting and documentation –; 3) the laboratorial and cabinet's work back in Lisbon. Finally, it will analyse the global circulation of knowledge and the controversy regarding tropical soils classification in the decolonization era. It makes use of both written sources (governmental and scientific) and oral sources (interviews with two of the pedologists involved in those expeditions: Ário Lobo Azevedo and Rui Pinto Ricardo), fieldwork photography, the Angolan monoliths and soil samples collection and a scientific object designed by the MPA team to improve the physical analysis and sample collecting: the "pedologist's box".

Session title: The Farm, the Landscape and the Laboratory in the Atomic Age

GENETIC LABORATORIES AS PLACES OF DOMESTICATION: THE HISTORY OF DNA POLYMERASE OF VIRUS PHI29

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Abstract

In 1989, the Spanish researchers Luis Blanco, Antonio Bernad and Margarita Salas were granted a patent of a DNA polymerase of virus phi29, a phage of bacteria *Bacillus subtilis*. The methods, procedures and laboratory practices that form part of this invention suggest processes that can be seen as the domestication of biological material.

I intend to present an historical reconstruction of the procedure by which the DNA polymerase was modified to make it a more efficient tool for the amplification of DNA fragments and the production of DNA molecules. The work carried out in this laboratory and recorded in the laboratory notebooks shows a fascinating process of experiments carried out, paths taken, decisions made, and a series of trial-and-error procedures. What the notebooks speak most eloquently about is genetic modification. In transforming a living thing – as, in this case, the virus phi29 most definitely is – it is essential to control both the biological material and the activity of this material. I suggest using genetic domestication to conceptualize this process, and to see the laboratories, much like farms, as spaces of domestication.

Session title: The Farm, the Landscape and the Laboratory in the Atomic Age

THE FIELD AND THE CYTOGENETIC LABORATORY: THE MAKING OF A CEREAL HYBRID WITH 42 CHROMOSOMES

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Abstract

In 1958 at the International Triticale Symposium, Spanish agronomic engineer Enrique Sánchez-Monge presented his project to obtain hexaploid triticale (a mixture of wheat and rye with 42 chromosomes). “The underlying idea is to obtain a new cereal with the milling and baking qualities of wheat combined with the drought resistance and the ability of rye to grow on poor soils”. After eight years of work, he was able to cultivate three Triticale types. I will tell the story of the Triticale project as part of an old trajectory of the improvement of cereal seeds at experimental cereal farms. Practical knowledge obtained in the experimental field combined with the new methods provided by cytology to manufacture a new cereal hybrid. Agricultural policy of the early Franco dictatorship also played a part, as did a growing research agenda on chromosomes as sub-cellular sites of heredity and on their visualisation. I will suggest that this combination of agriculture and the biological laboratory provides a story of multiple crossings which was at the core of genetic research during the long atomic age.

Session title: The Farm, the Landscape and the Laboratory in the Atomic Age

MARIA MONCLÚS AND *DROSOPHILA* POPULATION GENETICS IN SPAIN *(1950-1970)*

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Abstract

I will trace the early *Drosophila* population genetic studies in Spain after the Spanish Civil War (1936-1939) by placing Spanish biologist and entomologist María Monclús (Barcelona 1920) at the centre of the story. I will show Monclús's early biography through her influence in *Drosophila* population genetics and in *Drosophila* systematic and development studies in the research group in which she collaborated most intensively, the Centro de Genética Animal y Humana of the CSIC (Centre of Animal and Human Genetics) in Barcelona, led by her husband, Spanish geneticist Antonio Prevosti. Monclús earned a degree in Natural Sciences from the University of Barcelona in 1944. This same year she began her research career in physical anthropology, and a few years later shifted to population genetics and the ecology of diversity of the Drosophila species. She described two new Drosophila species: *D. guanche* Monclús (1976) and *D. madeirensis* Monclús (1984). She was also one of the first researchers to study intraspecific variability of *Drosophila*'s quantitative traits, which inspired her husband to work on the geographical variability of traits in *Drosophila subobscura.*

This presentation is a preliminary account of part of my PhD research project on the history of Drosophila in Spain during the Franco dictatorship. It allows an investigation into the particular characteristics of a research trajectory that developed apparently in the same socio-cultural moment, that of Monclús and Prevosti, but was at the same time necessarily different for being part of the hierarchy of a patriarchal society.

Session 12

SPEAKING THROUGH OBJECTS: THE SHAPING OF SCIENTIFIC KNOWLEDGE

Organizer: Joyce van Leeuwen

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The spread of scientific knowledge always consists of processes of transformation of knowledge. These transformations can be initiated by an increased practical knowledge, by experiential learning or by the formulation of new scientific concepts. The session will focus on the role of objects in this process of generating, disseminating and transforming scientific knowledge. The category ‘objects’ will be considered in a broad sense, that is including actual physical objects or artifacts as well as visual representations or diagrams. In the latter case it is impossible to strictly separate the visual images from the surrounding text as both of them are part of the scientific discourse, but the emphasis is on the objects and how they shape and communicate scientific knowledge. The role of objects as vehicles of communication can also be extended to the contexts in which the objects are found. How is knowledge formed and transformed depending on different situations or needs? What can we learn from the objects about the people behind them? Who are the users and audiences of these objects? At times we may find discrepancies between the intended or addressed audience and the actual users of the objects. While focusing on different cultural and linguistic areas from antiquity to the modern period, the papers present four cases in which objects shape and communicate scientific knowledge.

Session 12: Speaking Through Objects: The Shaping of Scientific Knowledge

IMITATION AND CREATIVITY: ON THE REPRESENTATION OF GEOGRAPHY AND CULTURE ON PORTOLAN CHARTS OF THE FOURTEENTH CENTURY

Sonja Brentjes

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Portolan charts are often perceived by researchers as products of meticulous copying through a variety of mechanical devices. On the other hand, place names and coastal lines are acknowledged to have underwent modifications and replacements in different phases and workshops. The transfer of knowledge is thus presented primarily as an act of imitation practiced by the whole group of chart makers, while the introduction of new knowledge has been seen as creative acts of individual chart makers based mainly on their experience on sea.

The study of inland territories and its verbal, pictorial and symbolic representation has not found the same kind of attention as the place names until very recently. Issues of imitation and creativity were not discussed in those studies. The interest of researchers concentrated more on questions of origin, meaning, function and typology. Prejudices about the skills and knowledge of chart makers contributed to misinterpretations and the various kinds of misunderstandings that characterize contemporary interpretations of the content of portolan charts and the relationships between chart makers from different regions and cultures.

In my paper, I will argue that the inland features of portolan charts made during the fourteenth century can only be understood if we decode the stories told by their producers and the messages they wished to deliver. My claim is that even when chart makers copied a previous chart they modified its content and form in numerous points and thus altered them in a creative manner, occasionally adding stories or messages not found previously.

Session 12: Speaking Through Objects: The Shaping of Scientific Knowledge

DIAGRAMS AND REPRESENTATIONS OF MECHANICAL KNOWLEDGE

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One of the most conspicuous features of ancient scientific texts is the presence of diagrams. The constant use of letter labels refers the reader's attention to accompanying diagrams, and makes it very difficult to understand these texts without diagrams. Therefore, it is remarkable that modern editors in most cases did not examine the diagrams contained in the manuscript sources for their critical editions of ancient science. Instead editors often insert their own diagrams that are remote from ancient tradition and interpret the texts in modern terms. The aim of this paper is to show the relevance of diagram studies to questions on the processes of transfer and transformation of knowledge.

The diagrams contained in the Greek manuscripts of pseudo-Aristotle's *Mechanics* and Hero of Alexandria's *On Automaton-Making* will be examined. Despite the different character of these texts – the *Mechanics* being the first extant theoretical treatment of machines, whereas *On Automaton-Making* is a Hellenistic technical manual on the construction of automata – we notice similar diagrammatic practices. I will point out that the manuscript diagrams are very different from the figures contained in the modern critical editions. Moreover, the diagrams in the manuscript sources are significant in relation to the text and to our understanding of the mechanical principles described in the text.

The diagrams do not only transmit the mechanical knowledge described in the text, but at the same time a transformation of this knowledge takes place. This becomes especially apparent in the diagrams in later Renaissance translations and paraphrases of these texts. My claim is that every diagram necessarily contains an interpretation of the text and thus reflects the author's different projects and state of mechanical knowledge at a certain period of time.

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Session 12: Speaking Through Objects: The Shaping of Scientific Knowledge

THE SPREAD OF GREEK MECHANICS IN HELLENISTIC AND ROMAN CULTURE

Matteo Valleriani

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The paper focuses on the transmission and transformation mechanisms of the Aristotelian mechanics during the Hellenistic period – specifically in the works of Hero of Alexandria but also taking into consideration a series of fragments – and during the epoch of the Roman Empire – in *De architectura* of Vitruvius – conceived in the frame of the spread of the whole Aristotelian knowledge.

The aim of the paper is to show the role of technology and of diffusion of technological artifacts as condition for the spread of scientific knowledge in antiquity. In particular, it will be shown that the mechanisms of maintenance, institutionalization and reproduction of technological knowledge as embedded and spread in the institution of the Roman military is the core of the scientific developments during the Roman Empire.

Session 12: Speaking Through Objects: The Shaping of Scientific Knowledge

COAL: A GLOBAL OBJECT OF KNOWLEDGE CIRCULATION

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Coal was the first natural resource to be traded worldwide. At the end of the eighteenth century and the first decades of the nineteenth, coal mostly coming from England was systematically trafficked in all parts of the than colonial world. England additionally was the center of knowledge creation about coal, about coal mining techniques and about kinds of coal usages. To an equal reduced extent, as coal mining represented a reduced economic activity, such knowledge was formed also in France, German countries and Spain, for instance.

But from the 1820s on, a change occurred: As an inevitable companion of the steam engine, coal began to be spread throughout the colonial world. In the following, coal mining activities were started in different colonial regions. With this spread of coal mining also the knowledge that had been accumulated in Europe came to other parts of the world.

This European knowledge met with differing social, economic and geographical conditions. In the consequence, the transferred knowledge had to adjust itself to those local situations. Furthermore, a local “colonial” process of knowledge formation started that challenged locally shaped European knowledge.

The talk will examine this process of inter-local competition of knowledge by emphasizing the aspect of re-adaptation of knowledge about coal gained in the colonies by the European scientific communities, related to the different mining schools all around Europe.

Session 13

RELIGIONS AS A MEANS FOR/AGAINST COMMUNICATING SCIENCES: ORTHODOXY, CATHOLICISM, AND REFORMATION.

Organizers: Efthymios Nicolaidis (National Hellenic Research Foundation, efnicol@eie.gr), Vincent Jullien (University of Nantes, vincent.jullien29@gmail.com)

The general theme of the Conference, communicating science, offers an interesting possibility to work on the question of the relations between science and religion. In what extend the main European Christian religions have been vectors of communicating science and/or obstacles to this. It is clear that the two aspects have coexisted and the Symposium aims to illustrate this twinning by giving precise examples. The question of how a secular or even atheist conception contributed to solve this contradictory function could also be investigated.

The Symposium does not intent to survey the whole question but only to contribute to the discussion on the theme. The case studies could concern various historical periods, from the beginnings of the Christian era to the contemporary period.

The Symposium aims also to illustrate the geographical dimension of this problematic. Indeed, the religions investigated, Catholicism, Orthodoxy and Reformation concern all the regions of the European thought, from Constantinople to Ireland and form Russia to Italy.

Exploring historically the relationship sciences-religions is essential in order to understand the relation societies - sciences. The “Needham question” (why certain societies rather than others develop a specific scientific practice) is closely tied with this relationship.

The Symposium aims to contribute to the filling of an important gap in the historiography of the history of science: while a huge literature exists on science and religion in Western Christianity there is almost a void for the areas of the Eastern Christianity. We aim to gather specialists for the study of the relations between science and religion concerning the three main components of Christianity, i.e. Catholicism, Orthodoxy and Reformation, in order to reveal unknown dimensions of science-religion relations in an interdisciplinary and comparative perspective.

Session title: Religion as a means for/against communicating sciences: Orthodoxy, Catholicism, and Reformation

THE EARLY-MODERN IDEA OF SCIENTIFIC DOCTRINE AND ITS ORIGINS IN CHRISTIANITY

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Abstract

One of most surprising aspects of the shift from scholastic natural philosophy to the new mechanist natural philosophies in the early decades of the seventeenth century is the retention of a doctrinal conception of knowledge. There was an assumption not only among scholastics, but also among many of their seventeenth-century opponents, that philosophy — and especially natural philosophy — had to take a doctrinal form. This is despite the fact that many of the considerations that motivated this view among the scholastics were rejected or ignored by their modernist opponents. The central argument of the paper is that doctrine is not something at the core of religions in general, but rather something of specific concern to Christianity. In looking at how this specific concern informs the development of natural philosophy in the seventeenth century, it emerges that it is not a one-way process: in entering into a symbiotic relation, Christianity and natural philosophy are both affected. Christianity becomes largely reduced to its cognitive content, becoming both more science-like and more focused on its doctrinal core, while at the same time the cognitive content of natural philosophy, already somewhat doctrinal in nature, now has this reinforced, as it becomes more like Christianity in its aspirations.

Session title: Religion as a means for/against communicating sciences: Orthodoxy, Catholicism, and Reformation

TWO CHRISTIAN SCIENTISTS OF THE XVIITH, DESCARTES AND PASCAL OBSERVED BY ONE OF THE 20th, PIERRE DUHEM.

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Abstract

I propose to examine three specific situations in which scientists believers try to organize the relationship between their religious beliefs and their scientific work. This is René Descartes, Blaise Pascal and Pierre Duhem.

If I compare those three is because the last of them, Pierre Duhem, clearly expresses about the other two: it is anti-Cartesian and pro Pascal.

At first sight, the situation is simple, there is a "dogmatic", Descartes, in respect of which metaphysics, and therefore the insured knowledge of the essential attributes of God, used to ensure the validity of the laws of nature and of the theses physical. And there are two more conventionalists scholars, more or less positivist where the dissociation between religious beliefs and scientific theories is in principle-complete.

However, on closer inspection, things are not so simple, for any of the three.

The certainty of scientific theories is not, for Descartes, similar or the same level as the metaphysical certainty; about Pascal and Duhem, epistemology that emerges from their cleavage between science and religion is fraught with difficulties: according to Pascal, it generates a radical devaluation of the "value of science," that is not worth more than a "game of piquet". And it leads Duhem to forge the strange concept of "natural classification".

These three examples show that it is, anyway, not easy to take philosophically together these two regions. We grant that this difficulty was not, in their eyes, which were good, an impossibility.

Session title: Religion as a means for/against communicating sciences: Orthodoxy, Catholicism, and Reformation

THE INVOLVEMENT OF SCIENCE IN THE DEBATE ON HESYCHASM

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Abstract

Barlaam of Calabria's (c. 1300-1350) involvement in the discussions over the Eastern and Western churches became the pretext for the controversy that opposed the Calabrian scholar and the hermit monk Gregory Palamas, leader of the Hesychast movement in the Byzantine 14th century. Palamas argued that the only worthwhile knowledge was theosophy, which could be attained only by purging oneself of secular wisdom while Barlaam was a follower of Ancient Greek philosophy of nature.

It would be however a mistake to see the Hesychast movement (especially its leader Palamas) as hostile to secular learning as such. Palamas was interested in secular knowledge, notably that which described and explained Creation; he proceeded by deductive reasoning based on sense perception. But this method was not sufficient for him because it was likely to lead to erroneous conclusions. In order for knowledge based on experience to be valid, it must follow the interpretation of Creation given by the church fathers, especially Basil. But-- and this is particular to the Hesychast movement--the world in which we are living is not composed for Palamas of physical reality alone. According to Palamas, to limit man to perceiving merely the created world would be to condemn him to spiritual misery. A Christian is open to another world that was not created by the imagination of Hellenic philosophers--namely, the uncreated world of spiritual powers. On another hand, Palamas uses Aristotle and presents a theory on the position of the element water based on the ideas on physics of the Ancient Greek philosopher.

In this paper we will present the main themes about science involved in the Hesychast debate which divided the Byzantine society during the 14th century. We will notably try to seek the consequences of this debate on scientific knowledge during the second Byzantine Humanism (14th-15th c.). Did this debate have influenced the Byzantine society in order to accept or not scientific knowledge?

Session title: Religion as a means for/against communicating sciences: Orthodoxy, Catholicism, and Reformation

THE CULTURAL REVOLUTION OF DINOSAURS AMONG CONSERVATIVE CHRISTIANS: FROM EVIDENCE OF EVOLUTION TO SYMBOL OF CREATIONISM

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Before World War II and even into the postwar period conservative North American Christians tended to view dinosaurs as highly suspect evidence of evolution. Some doubted that dinosaurs had ever existed; others viewed them as a Satanic trick. In recent decades, however, dinosaurs have become the darlings of creationists. Ken Ham's 27-million-dollar Creation Museum in northern Kentucky, for instance, features nearly 30 dinosaurs, which, the museum proclaims, appeared on earth no more than 10,000 years ago and for millennia shared the planet with humans. The associated Answer in Genesis bookstore sells dinosaur jigsaw puzzles, stickers, coloring books, mugs, journals, activity books, bookmarks, books, and magazines, aimed primarily at children. A number of creationist colleges proudly promote dinosaur museums and field excavations. This paper explores how this counterintuitive dinosaur revolution occurred.

Session title: Religions as a means for/against communicating sciences: Orthodoxy, Catholicism, and Reformation

CATHOLIC RESPONSES TO EVOLUTION, 1859-2009: LOCAL INFLUENCES AND MID-SCALE PATTERNS

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Abstract

This article discusses Catholic responses to evolution between 1859, the year of publication of Charles Darwin's *On the Origin of Species*, and 2009, the year in which the scientific world celebrated its 150th anniversary. Firstly, I will discuss how the Vatican initially responded to evolution in the period between 1859 and 1907, the year in which Pope Pius X issued the encyclical *Pascendi dominici gregis*. Secondly, I will explore the responses of Catholic authorities and intellectuals and identify the local factors that influenced their responses. Also, I will demonstrate that, gradually, Catholics have shifted towards a more lenient position concerning evolution. Thirdly, I will demonstrate that, in the end, the Vatican has complied with this pattern. In general, this article shows that not only Protestants, but Catholics too have struggled to come to terms with evolution and evolutionary theory and that local factors had an impact on these negotiations.

Session title: Religions as a means for/against communicating sciences: Orthodoxy, Catholicism, and Reformation

THE EARTHQUAKES IN BYZANTINE WRITERS INTERPRETATIONS BETWEEN NATURAL AND SURNATURAL.

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Abstract

Earthquakes are for the medieval thought one of the less conceivable natural phenomena resisting to a global explanation, as pointed by G. Dagron in his classical study entitled “When the Earth shakes”.

Based on a selection of representative texts on this subject, we try to show how Byzantine authors described, understood and explained this phenomenon arousing the religious imaginary as an Apocalyptic sign but also requiring rational explanations.

First of all, we will insist on the identity of the authors (historians, chroniclers, scholars, theologians but also astrologers) in order to highlight the core of their ideas related to the context that gave them birth.

Secondly, we aim to investigate the concept of nature derived therefrom and the conceptual elements (religious and/or philosophical) they use for this purpose in the broader perspective of God’s relationship with Man and Nature.

In conclusion, we try to comprehend how these diverse explanations, fluctuating between Natural Causes and religious beliefs on Divine Economy, reflect the regressions, impulses and major conceptual tendencies that cross the history of ideas and sciences in Byzantium revealing the issues attached to them over the centuries.

Session Title: Religions As A Means For/Against Communicating Sciences: Orthodoxy, Catholicism, And Reformation

NETWORKS OF AUTHORS, COLLECTORS, PUBLISHERS, AND ILLUSTRATORS EXEMPLIFIED BY SCHEUCHZER'S COPPERPLATE BIBLE

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Abstract

The Swiss physician, naturalist, and historian Johann Jakob Scheuchzer (1672-1733) left behind a huge oeuvre which is hard to survey in its entirety. Consequently it has never been completely treated either scientifically or regarding the critique by its readership. The high-water mark of Scheuchzer's copious works is the so-called Copperplate Bible (*Kupferbibel*), having been published in four folio volumes between 1731 and 1735. Scheuchzer attempted not only to represent all natural things mentioned in the Bible but also to explain them. His immense knowledge about nearly everything was quite useful in reaching this goal, but he also benefitted from his many contacts within the European Republic of Letters. He discussed ideas with other scholars in numerous letters who often provided him with items or/and images out of their own collections of natural objects. The Copperplate Bible is rather a natural history book taking the Old Testament as its starting point. It is considered Scheuchzer's magnum opus, his most renowned achievement, and is also one of the most beautiful baroque prints, due to the 762 illustrations by 26 copperplate engravers after paintings or drawings by four painters or draftsmen. Scheuchzer held these artists in high esteem. So contrary to the contemporary practice he listed them together with short biographical notes. However this list is incomplete, a gap that has remained unnoticed. Here I briefly discuss all the contributing artists to Scheuchzer's bible and analyze their network of ties in their family, educational and work settings. Some exemplary patrons, publishers, and scholars are also considered. Thus it could be shown that every artist had a small individually coined ego-network, together forming the mega-network essential for the creation of a book like the Copperplate Bible. Thus a gap in the research dedicated to Scheuchzer is filled.

Session title: Religions as a means for/against communicating sciences: Orthodoxy, Catholicism, and Reformation

THE CIRCULATION OF SCIENTIFIC KNOWLEDGE AMONG PROTESTANTS IN RURAL DENMARK IN THE DECADES AROUND 1900

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Abstract

The fact that the influential Evangelical-Lutheran clergyman N.F.S. Grundtvig (1783-1872) was highly critical of natural science, exclusively preferred literary and historical aspects in his concept of formation, claimed that “man is no monkey” and appears never to have accepted heliocentrism might lead to the supposition that Grundtvig’s followers, who played a prominent role in religious, cultural and educational life in nineteenth- and twentieth-century Denmark, remained sceptical towards scientific and technological developments, rejected controversial scientific theories such as Darwinism and did not engage in the dissemination of scientific knowledge. As this paper will demonstrate, the case is more complicated than that. True, most Grundtvigians were critical towards positivist, materialist and Darwinian worldviews. However, many Grundtvigian clergymen, teachers and laypeople eagerly embraced new scientific discoveries and technological inventions and disseminated these ideas to large segments of the rural population through lectures, periodicals, books and commodities. In particular, Grundtvigian people’s high schools and agricultural schools played a seminal role in disseminating useful knowledge of agriculture and electricity to the rural youth. This resulted in a rapid modernisation of Danish agriculture which, through cooperative organisation, succeded in capturing substantial market shares from the 1880s, and thereby laid the economic foundation of the Danish welfare state.

Session title: Religions as a means for/against communicating sciences: Orthodoxy, Catholicism, and Reformation

COMMUNICATING SCIENCES IN CATHOLIC CONTEXTS: THE CHOICES OF TWO MEDIEVAL SCHOLARS

Matthieu Husson

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Abstract

The question of sciences and religion is, for the historian of medieval sciences in Europe, a key and a classical one. The story told is often one of successive epistemological crises leading slowly to a divergence between sciences and religion. Looking at this issue from the perspective of sciences as a communication enterprise is an opportunity to displace the usual approaches. My intention here is not to add any new big thesis but rather to explore this original way to treat the issue by the examination of the intellectual biographies of two important medieval scholars which I believe will present a contrasting image. Dietrich von Freiberg was, in the second half of the 13th century, an important member of the Dominican order, a theologian and a natural philosopher of first rank. John of Murs was, in the first half of the 14th century, a Parisian master of the arts faculty whose contributions to mathematics, music and astronomy were considered up until the 16th century. Being the closest we can to the actual intellectual practices of these two scholars we will compare what aspects of these practices were shaped by the catholic context, what aspects seems more or less independent, and in what way they may have used the catholic contexts for their own purposes.

Session 14

COMMUNICATING CONCEPTUAL CHANGES IN THE PHYSICAL SCIENCES

Organizer: Jaume Navarro

Communicating is not a passive activity in the development of science. Following in the line of Ludwig Fleck, one can say that the act of exchanging information is, in itself, part of the process by which theories and concepts are construed. Fleck's historiography has been very influential in the work of historians of the bio-medical sciences, but less so in the case of the physical sciences (broadly understood). The goal of this panel is to study the role of communication in the dissemination and configuration of new concepts and theories in physics and chemistry, as well as the abandonment or rejection of previous ones. We are especially thinking of case-studies related to novel physical ideas that relate to the development and establishment of "classical" and "modern" physics. Actors in these case studies extend not only to "top" theoretical physicists but also to engineers, popularisers, and other practitioners of science.

Session Title: Communicating Conceptual Changes In The Physical Sciences

DON'T ASK WHAT THE THEORY CAN DO FOR YOU, ASK WHAT YOU CAN DO FOR THE THEORY.

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Abstract

In this paper I present a case study in 20th century physics to explore the meeting of theoretical and experimental driving forces and their impact on the evaluation of theories and research programmes. Taking crucial episodes from the century-long quest for the understanding of superconductivity, I want to unearth the implicit preferences expressed by the most important scientists in the field. In particular, drawing from the history of the field, I locate and discuss the different sets of philosophically rich strategies expressed by Nobel laureates John Bardeen and Richard Feynman. I argue that behind these different preferences lie different conceptions of what it means to formulate a theory and to succeed in problem solving and in new conceptualizations; this motivates an integrated historical/philosophical analysis as epistemically crucial and opens the road to a promising engagement between integrated philosophy of science and science as practiced.

Session Title: Communicating Conceptual Changes In The Physical Sciences

"MODERN" PHYSICS ENTERS THE BELL LABS: RESISTANCE AND COMMUNICATION IN AN INDUSTRIAL LABORATORY

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Abstract

The reconfiguration of knowledge following the formulation and the positive reception of special relativity and quantum theory was a complex process that deeply affected scientific practice during the first half of the 20th century. Different subcommunities of scientists reacted in a variety of ways to the advancement of "modern" physics. Industrial laboratories had to face these momentous theoretical transformations while continuing producing technological innovations and modifying their own organizational structure. Industrial laboratories' directors and researchers employed a series of communication strategies to keep an updated knowledge of what was being produced elsewhere. After its foundation in 1925, the Bell Telephone Laboratories became one of the industrial research facilities that made most to acquire and actively contribute to the evolution of "modern" physics reaching the noteworthy number of seven Nobel Prizes in Physics awarded for researches carried out therein from 1927 onward. This assimilation of new physical ideas was far to being straightforward, however. Some Bell Labs' first-rate researchers vehemently opposed the novel theories and tried to build theoretical alternatives based on some kind of electromagnetic ether. The aim of the present talk is twofold. First, I will explore the epistemic commitments of those scientists who opposed special relativity and quantum theory as well as the interconnections between these commitments and their daily work on electronic devices. The two actors on which the present analysis stems are Hebert Eugene Ives (1882-1953) and Ralph Vinton Lyon Hartley (1888-1970) who persistently challenged the theoretical core of "modern" physics by writing several papers aimed at promoting a return to an ether theoretic approach. Second, I will compare the communication strategies these scientists devised with those employed by Karl Kelchner Darrow (1891-1982) who, conversely, took the task of synthesizing and interpreting the novel theories for the Bell Labs' researchers.

Session Title: Communicating Conceptual Changes In The Physical Sciences

FROM TERMINOLOGICAL DISREGARD TO CONCEPTUAL MISUNDERSTANDING

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Abstract

It will be argued that one of the main reasons for the difficulty in communicating the novel concepts of physics lies in the linguistic carelessness of modern physicists. It will be shown that terms such as "big bang", "black hole", "superstrings", etc., not to mention "relativity" or "quantum uncertainties", uncritically spread out by communication channels, give rise to deep misunderstandings among laypeople and end up in hampering the theoretical awareness of scientists themselves.

Session Title: Communicating Conceptual Changes In The Physical Sciences

COMMUNICATING QUANTUM MECHANISMS ON A MACROSCOPIC SCALE

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Abstract

Fritz London presented his seminal idea of "quantum mechanisms on a macroscopic scale" (today's "macroscopic quantum phenomena") at the "Fundamental Particles and Low Temperature Physics" conference, which was held at the Cavendish Laboratory in Cambridge, UK, in July 1946. This dual conference was the first international gathering of physicists after WWII, and represented a turning point in the historical development of physical research. London's aim was to explain the low-temperature phenomena of superfluidity and superconductivity on the basis of the novel conception of matter that emerged from quantum mechanics. His choice of venue for the communication and the impact of his theory are examined in the context of his controversy with Lev Landau and the broader changes in the international physics community.

Session Title: Communicating Conceptual Changes In The Physical Sciences

EXPLAINING THE DEMISE OF THE ETHER

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Abstract

Historians of science have paid much attention to the demise of the *electromagnetic* ether among professional physicists, with particular emphasis on the theoretical and mathematical work of the main actors in the formulation of the new physics in the early decades of the twentieth century. Recent historical work has led to the rejection of the old, but still popular thesis that Michelson and Moreley's famous 1887 experiment with light interferometers acted as an *experimentum crucis* that almost instantaneously forced the abandonment of the ether (Collins & Pinch 1993, Staley 2008). The ether remained alive for decades after that experiment, and we should think of the ether as something being abandoned rather than falsified.

In this paper I want to explore the more than probable misunderstandings among less well-known scientists, science popularizers and secondary school teachers on what the abandonment of the ether really meant. On this matter, sentences like "what used to be called the ether but is now called the space", that one often finds in popular books and articles in the 1920s and 1930s, show that the foundations of "classical" physics were so deeply engraved as common sense, that the explanatory power of the ether could not be so easily done away with, even by those who were actually explaining its abandonment.

Session 15

HYPNOTISM AND THE CIRCULATION OF KNOWLEDGE IN WESTERN EUROPE, 1880-1914

Organizer: Kaat Wils

The history of late 19th and early 20th century hypnotism challenges historians of science. Hypnotism played a constitutive albeit contested role in the formation of disciplines such as psychology, psychiatry and legal medicine, while it was at the same time popular in lay medical therapies and in private and public forms of entertainment. Both as a practice and as an intellectual problem, hypnotism found itself on the margins of what was considered as 'science'. As a field which never became fully institutionalized or recognized, it was doubly taken in processes of circulation of knowledge, across national and across disciplinary boundaries. In this symposium, the transnational circulation of concepts and practices of hypnotism and the 'local' migrations of concepts and meanings between intellectual fields or between 'science' and its others will be explored.

In a field which had difficulty to establish itself within traditional, nationally structured institutional settings, transnational initiatives – including international conferences, journal publications and small scale initiatives such as individual visits and correspondence between scholars - may have played specific roles. What was the role, for instance, of transnational contacts in individual scholars' search for scientific authority in locally or nationally defined settings? And did the existence of (informal) transnational networks of scholars play a role in national debates on the need to regulate the practice of hypnotism, or on its alleged benefits or dangers? In a similar vein, questions of authority and expertise were at play in the interaction between neighbouring fields. How were lay practitioners for instance referred to by scholars who sought to establish hypnosis in a recognized scientific discipline? What types of contacts between different actors – and specifically between lay practitioners and recognized scholars or experts - did actually exist? How were notions of 'lay' and 'expert' defined in this process?

Session title: Hypnotism and the circulation of knowledge in Western Europe, 1880-1914

THE DEBATE ON HYPNOTISM IN ITALIAN PSYCHIATRY (1880-1910)

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Abstract

In Italy, the 1880s witnessed a growing scientific interest for animal magnetism and hypnosis. Initially stimulated by French and German studies, a number of psychiatrists, in particular those trained at the San Lazzaro asylum, in Reggio Emilia, engaged in the normalization of the supernatural phenomena attributed to magnetism and in experimental work aimed at elucidating the physiological and psychological processes involved in hypnotic states. By examining the professional and intellectual trajectory of Augusto Tamburini, Cesare Lombroso, and Enrico Morselli and their different interpretations of the hypnotic fenomenology, my paper aims at retracing the influences of the European debate on Italian psychiatry.

Session title: Hypnotism and the circulation of knowledge in Western Europe, 1880-1914

HYPNOSIS AND SPIRITIST MEDIUMSHIP IN SPAIN: FROM SPECTACLE TO MEDICAL TREATMENT

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Abstract

This paper explores little-known historical cases, documenting first uses of hypnotism in Spain, in regard to the question about the relations between experts and lay practitioners and the circulation of spiritist practices throughout Europe, in the years shortly before and after the turn of the 19th century. Our aim is to determine the role that spiritists played in the process of legitimizing medical hypnosis. Towards the end of the nineteenth century, some Spanish physicians sought to legitimize hypnotherapy within medicine. At the same time, hypnotism was being popularized among the Spanish population through stage hypnosis shows. In order to extend the use of medical hypnotherapy, some physicians in Spain and other countries, made efforts to demarcate the therapeutic use of hypnotic suggestion from its application for recreational purposes, as performed by stage hypnotists. However, in the eyes of some physicians, the first public session to legitimize hypnotherapy turned out to be a complete failure due to its similarities with a stage hypnosis performance. At a time when Spanish citizens were still reluctant to accept hypnotherapy, the spiritists sponsored a charitable clinic where treatment using hypnosis was offered.

Session title: Hypnotism and the circulation of knowledge in Western Europe, 1880-1914

THE PUBLIC DEBATE ON THE LEGAL REGULATION OF HYPNOTISM IN BELGIUM IN A TRANSNATIONAL PERSPECTIVE

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Abstract

On the 30th of May 1892, the Belgian Minister of Justice Jules Le Jeune and King Leopold II signed a law on the exercise of hypnosis. The law prohibited public demonstrations of hypnotism and limited the right to perform hypnosis on minors and mentally ill persons mainly to medical doctors. The signing of the law constituted a temporary closing point of three years of medical, political and public debate on the dangers and promises of hypnosis. My paper aims to chart the role of transnational networks and international debates on hypnosis in this specific Belgian debate.

Claims by proponents of a strict regulation were specified or legitimized by referring to Swiss, French and Italian authors who since 1880 expressed their concern on the effects of the public performances of travelling magnetizers. One of these popular magnetizers was the Belgian Edouard Dhont, known under his stage name Donato. References to local or national bans on Donato's shows in Switzerland, France and Italy were eagerly made. Transnational contacts did, however, also play a role in an opposite way. Contrary to the advice of the Academy of Medicine, the Belgian law created the possibility to acquire a special, individualized permission from the government to practice hypnosis without a medical degree. The internationally acknowledged expertise in matters of hypnosis of the Liège professor Joseph Delboeuf, a fierce opponent of a monopoly for doctors, seems to have functioned as the main leverage to create this opening in Parliament.

Session title: Hypnotism and the circulation of knowledge in Western Europe, 1880-1914

CRIME AND HYPNOSIS IN FIN DE SIÈCLE GERMANY: THE CZYNSKI TRIAL

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Abstract

Lurid tales of the criminal use of hypnosis captured both popular and scholarly attention across Europe during the closing decades of the nineteenth century, culminating not only in the invention of fictional characters like Du Maurier's Svengali, but also in heated debates between physicians over the possibilities of hypnotic crime and the application of hypnosis for forensic purposes. The scholarly literature and expert advice that emerged on this topic at the turn of the century highlighted the transnational nature of research into hypnosis and the struggle of physicians in a large number of countries to once and for all prise hypnotism from the hands of showmen and amateurs. Making use of the 1894 Czynski trial in which a Baroness was putatively hypnotically seduced by a magnetic healer, this paper will examine the scientific, popular and forensic tensions that existed around hypnotism in the German context. Focussing, in particular, on the expert testimony about hypnosis and hypnotic crime during this case, the paper intends to show how such trials could be used both to disseminate scientific knowledge and to stake one's claim over it.

Session 16

MAPPING, ILLUSTRATING, DESIGNING: COMMUNICATION STRATEGIES TO EMPOWER RESEARCHERS, CLINICIANS AND PATIENTS

Organizers: Roberta Buiani

With their current diversity, medical images merge ways of expression of apparently unrelated fields, carry a huge emotional weight, and imply a deep, nearly personal connection between subject and investigator, between patient and physician while finding a life of their own by dissemination in the public domain. While this quality has always accompanied these visual artifacts, their form, function and material configurations have substantially changed as medical and research disciplines underwent increasing specialization and technological transformation. The risk with hyper-specialization is that the medical image can be turned into a self-referential tool that only insiders may be able to decipher. Yet, its powerful affective content makes it impossible for the medical image to shed its profoundly relational value.

This unique, multidisciplinary panel brings together expertise in the History of Art and Science (SC), Science and Technology Studies, (KF), Biomedical Sciences (DS), and Media Theory (RB). We propose a series of reflections on the ability of the medical image to function as a relational object, as in-between, as communication link between the researcher, the clinician, and the patient. Starting from early medical images disseminated to the larger/ lay public in the XVI century (Carlino), we will illustrate how three contemporary practices are trying to make the most of the relational and affective content of the medical image in order to not only evoke emotional and physical reactions in its interlocutors, but also to facilitate the mutual understanding and cooperation between researcher, clinician and patient. Through the data-driven caricatures of biomedical illustrator John Harvey, the big-data/information maps by mathematical physicist Joseph Geraci and artist Ron Wild, and an analysis of recent development in the design of of neurodevices and biointerfaces (e.g. Elio Caccavale's work), we wish to stir a debate on the role of communication in medicine.

Session title: Mapping, Illustrating, Designing: Communication Strategies to Empower Researchers, Clinicians and Patients

WOULD THE "UNSEEN" STAND UP? ONCOMAP AND THE RISE OF RELATIONAL COMMUNICATION

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In examining scientific and medical images of the body disseminated in the XVII century, Stafford uses the term “unseen” to refer to what cannot be expressed with words or images, or by using any language that precisely addresses it (visual, written or spoken). The iconographical tradition that Stafford analyzes (Stafford 1993) had a keen interest in capturing and transmitting elements such as fear, pain and discomfort, insidious danger and terror. These only to a certain extent constitute subjective or aesthetic interpretations of the effects of a disease over an individual. They are also attempts to record and to map the symptomatic course of a disease. Today, different typologies of images have become available thanks to a variety of technological devices that help clinicians, technicians to interpret and diagnose specific conditions and the patient to grasp the nature of the disease he/she is carrying. Are the highly specialized and precisely delineated illustrations produced today providing a much deeper understanding of a condition? How do selective interpretation, or diverse degrees of visual literacy affect their interpretation? Is the fragmentariness and hyper-specialized nature of these illustrations able to provide a comprehensive picture of the complexities that underlie a disease? To start answering these questions, I will examine Ron Wild and Joseph Geraci’s Oncomap as a modern version of Stafford’s images. An artist/scientist collaboration, Oncomap attempts to visualize the complexity of Cancer research, diagnosis and treatment in one single place in order to underline its complicated technical, scientific and emotional intricacy. I am interested in drawing a comparison between the early images mentioned by Stafford and the later hyper-specialized products of imaging. I am wondering if they, alone, could ever produce comprehensive understandings that clarify and specify without de-humanizing or reducing the body of the patient to an agglomerate of molecular(ized) components.

Session title: Mapping, Illustrating, Designing: Communication Strategies to Empower Researchers, Clinicians and Patients

PERFORMING THE SELF: OBJECTS, STRATEGIES AND SCENARIOS IN BETWEEN DESIGN AND NEUROSCIENCE

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The molecularization of the body, prompted by research in biomedicine and genetics after the Second World War and enabled by the advent of computers opened up a new era in the visualization of the body and of the brain (Zwijnenberg 2010). One of the problems of neuroscientific and biomedical research is to lose touch with the object they investigate (for example, the cognitive processes of the brain): many neuroscientific data resist depiction and, therefore, display too. Given the difficulty to make this research tangible, one of the most promising areas of communicating scientific research in this field entails design, and involves neurodevices and biointerfaces. As such devices operate directly on the brain, they might have different implications than other means of enhancement. Adopting the critical framework of image science (Grau 2011; Elkins 2008), visual STS (Woolgar et al.2013), philosophy of technology (Ihde 1998; Latour 1987; Stiegler 1998, 2010), I attempt to investigate the role of visuality and embodiment in some selected example of collaborative projects between designers and scientists. I shall argue that design creations (not only objects, but also scenarios or strategies) in neuroscience and biomedicine might prompt the lay public to expand existing concept of the human being and to maintain a freedom of speech when talking about the body (Latour 2004), transforming the lay public in an active performer rather than a passive actor.

Session title: Mapping, Illustrating, Designing: Communication Strategies to Empower Researchers, Clinicians and Patients

EVERYTHING OLD IS NEW AGAIN: ILLUSTRATION AND CARICATURE FOR COMMUNICATING COMPLEX MEDICAL IMAGES

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The exploration of the body has always been a multi-disciplinary endeavor, involving experts from the fields of anatomy and physiology as well as engaging visual artists and making use of the technological developments of the time (Stafford, Elkins). Our research - that of blood flow patterns and the consequences of their alterations due to blood vessel geometry variations and modifications - requires the translation of patient biological data into visual representations of the phenomenon. From a communication's standpoint, we are striving to create a clear and accurate novel visual vocabulary that would allow both engineers and clinicians to recognize the information embedded in the image, an all-encompassing interactive visual map that translates the mathematical formulae found at its root, able to stand on its own and withstand potential misappropriations and misuses. Our latest foray down this path is a new twist on an age-old technique: drawing. With the deep insight of a media artist/theorist with particular interest in cartoons and caricature (and their power of emphasizing the essential or the particular) and the exquisite drawing skills of a biomedical illustrator, we are updating this way of body representation, this time visualizing also the unseen yet complex phenomenon. This visualization is updated and made current not only by its ability of being "user friendly" but also by representing in an organic way events taking place within the living body. We would be happy, given the opportunity, to share our practitioner's perspective aligned with that of our colleagues within the panel/ session proposed.

Session title: Mapping, Illustrating, Designing: Communication Strategies to Empower Researchers, Clinicians and Patients

BETWEEN PLANNING AND INTERVENTION: IMAGES AS COMMUNICATION STRATEGIES IN RADIATION THERAPY

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Digital images are a *sine qua non* of clinical radiation therapy since they are applied as communication strategies between multiple actors. Visualizations acquired by diagnostic imaging technologies such as computed tomography or magnetic resonance imaging guide the process of detecting tumors, planning treatments and finally carrying out radiation. In particular, the pre-planning phase of radiation treatments is crucial for communicating diagnostic findings and further treatment options on the basis of images among physicians, technicians and patients. Physicians use interactive software tools to identify tumors, accordingly plan the paths of rays and mark sensitive tissues. Afterwards, these 'plans' are processed as the digitally encoded input for linear accelerators that focus on the tumor inside the patient's body. Additionally, physicians communicate the planned interventions to patients by illustrating them on the basis of the visual 'maps' of the patient's own body. Therefore, the very same digital image is used as an illustrative tool for communicating with patients, as a pre-planning and design device as well as it is applied as a technological input. I will explore the multilayered functions and relations of radiation oncological pre-planning images as communication strategies to show their profound impact on clinical therapy that literally affects the patient's body. By drawing on media theory (Manovich, 2013; Rossiter, 2003) and studies of multimodal interaction (Alač, 2011) I will show how images act simultaneously as a 'pragmatic' relation and a communication strategy between planning and intervention in clinical contexts.

Session title: East-West Transnational Vectors at Work in European Experimental Sciences

SCIENTIFIC EXCHANGES BETWEEN EAST AND WEST COUNTRIES UNDER THE DIRECTION OF HENRI GASTAUT (1915-1995)

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Abstract

We will focus on the European construction of knowledge in experimental sciences, in particular, during the Cold War. In the fields of medical knowledge about the brain, we will analyse the manner in which scientist from East and West gave shape to them. If we consider that personal relationships have contributed to “open windows” in the Iron Curtain, we should focus on studies between East and West scientists.

In the fifties, Henri Gastaut, a great French epiteptologist, organized, for few years, international symposiums about different neurological pathologies. Indeed, he made many scientific exchanges between these countries. Therefore, he organized exchanges between Marseille and Moscow.

What was the influence of these international meetings on neurological patterns? Can we consider, for instance, that H. Gastaut facilitated the diffusion of Pavlov's theory about reflex and conditioning in Western countries? What was the involvement of Eastern countries in those networks? What were the scientific consequences on the different kind of epilepsies and their classification?

Session title: East-West Transnational Vectors at Work in European Experimental Sciences in 20th Century

PAVLOV AND SOVIET MEDICINE

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Abstract

The soviet past is fundamental to our understanding of the medical thought. In the fifties, under the authority of Pavlovian principles, the entire medicine was redefined.. In communist countries, strangely, physicians and scientists were suddenly “invited” to reinterpret their works in Pavlovian terms. Western communist parties celebrated triumph of the Pavlovian doctrine and “the Stalinist marriage of Pavlov to Marx” (D. Joravsky). What did that mean? A distinction was imposed between “authentic” disciples of Pavlov and the others. Was it truly meaningful? With distance and hindsight, the bet is here to take Pavlovian medicine seriously, from a philosophical point of view, that is, other than an unfortunate side effect of Stalinism. The aim of the paper is to raise some fundamental questions concerning the Pavlovian “break” in medicine: was there a true theoretical or epistemological identity for soviet medicine? What were the actual vectors and ideological roots for it? How did Pavlovian principles apply in term of actions and therapies? Finally, what Pavlov’s ideas had to do with that?

Session title: East-West Transnational Vectors at Work in European Experimental Sciences

CELEBRATE A COMMON PAST IN A DIVIDED WORLD. SCIENTIFIC COMMEMORATIVE EVENTS BETWEEN EAST AND WEST

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Abstract

The commemorations of scientists during the Cold War played an important role in the relations between the opposing scientific worlds. These festive and special events were the occasion of solemn meetings and scientific symposia which brought together scientists from both sides of the Iron Curtain, thus highlighting the unity of European science.

Organized with the support of national and international scientific and cultural institutions (UNESCO, associations), these celebrations also had a political role. They had to keep alive the memory of scientists who lived in the period before the war and thus emphasize the continuity of a national science, beyond the break introduced by the communist regime. They were meant to bring forth, in a demonstrative manner, the role of science in popular democracies, mobilize schools, exhibitions and mass media around scientific achievements and thereby strengthen national pride. But they also had a strictly scientific function: they allowed to bring guests from several countries, establish or maintain relationships with foreign scientific organizations and discuss scientific issues in important scientific areas for the host country.

This paper will focus on the scientific commemorations in life sciences (biology, agronomy and medicine) in Romania between 1945 and 1970. It examines the choice of celebrated personalities, the participation of scientists from Eastern and Western countries, the national rhetoric of unity and continuity of science as well as scientific topics considered. Its aim is to question the past practices in Romanian science policy during the Lysenkoist period.

Session title: East-West Transnational Vectors at Work in European Experimental Sciences

THE SOVIET LIFE SCIENCES IN THE NOTES OF FRENCH EMBASSY COUNSELORS DURING THE COLD WAR

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Abstract

During the Cold War the scientific services of Western embassies in Moscow were in a relevant position to observe and analyse Soviet Sciences.

This paper focuses on the notes written by scientific counselors of the French Embassy in Moscow during this period. I am particularly interested in their analysis and comments about biology and medicine. Both topics were directly concerned with the particular context of the Lyssenko policy.

After a short reminder of the lyssenkoist context, three constituent aspects of these notes will be analysed: firstly, the description of the scientific data, secondly, the presentation of the institutional and political context and finally, the rhetoric used by the counselors.

The goal of this paper is to estimate the effectiveness of those notes as vectors of information about the state of life Sciences in USSR.

Session 19

TRANSLATING HOW TO

Organizers: Sven Dupré, Elaine Leong

Early modern Europe was flooded with books of how-to. Manuals and treatises offering readers a wide range of artisanal and practical knowledge ranging from shipbuilding to glassworks to medicine production to knitting. Yet, many of these texts were translations, either from preexisting learned Latin texts or from other vernacular examples. This session explores the translation of artisanal knowledge in early modern Europe. The papers concentrate on the various contexts within which erudition confronted local knowledge. These confrontations often involved issues of expression, particularly in areas where both knowledge and language structures turn out to lack the necessarily building blocks. Building on the vast body of work addressing the massive translation migration of classical texts from Latin into the vernacular during the Middle Ages and the Renaissance, the papers aim to locate confrontations between the erudite and the artisanal within specific historical and knowledge contexts. They view translation as an epistemic process through which information and knowledge is transferred from one place to another. This transfer process often subtly alters the original body of knowledge. Thus, change, deliberate or not, is not incidental to translation but its very essence. Of course, the process and practice of translation itself is subject to change over time making them objects of historical investigation. The papers in this session focus on two main themes. Firstly, they investigate if and how the translation – also in the sense of 'rendering' - of artisanal knowledge changed in the early modern period. Secondly, they focus on the agency of the human actors in the translation process: the identity and the visibility of translators and the audiences of how-to books and artisanal knowledge.

A pedagogic project for a 15th century court: Michele Savonarola as self-translator
Gabriele Zuccolin

Purposeful knowledge, purposive language: Foreign experts, Russian bureaucrats and translation in early modern Russia
C. L. Griffin

Jan Baptista Van Helmont and the difficulties of using his medical recipes
Sietske Fransen

Commentator: Elaine Leong

Session Title: Translating How To

PURPOSEFUL KNOWLEDGE, PURPOSIVE LANGUAGE: FOREIGN EXPERTS, RUSSIAN BUREAUCRATS AND TRANSLATION IN EARLY MODERN RUSSIA

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Abstract

In seventeenth-century Russia, the court medical department, the Apothecary Chancery, was a part of a network of central departments, which both implemented the tsar's orders and provided Russian bureaucrats with information in the form of written reports and translated medical books. Foreign medical practitioners, men of varied backgrounds recruited primarily from Protestant Northern Europe, composed the Apothecary Chancery's reports, providing expert advice on medical issues as part of their administrative duties. These reports, initially composed in Latin, were rendered into Russian by translators, who were vital intermediaries between the foreign experts and their Russian masters. Once the final version was ready, the report would be sent to the department head and from there to heads of other departments, to the tsar's counsellors, or even to the tsar himself. Thus translations formed an essential part of the circulation of knowledge at the Russian court.

Although a number of studies have been devoted to the Apothecary Chancery, the work of the translators has been little studied. Examination of the reports reveals how vital translation was to shaping the final version of the report: both the phraseology and the contents were subject to revision by translators, sometimes significantly revising the meaning of the original. The final, Russian-language versions of Apothecary Chancery reports were not simple translations of Western knowledge, but adaptations of that material to Russian ideas and Russian needs. Translation of medical texts at the Russian court demonstrates the highly selective approach of Russians to Western knowledge. Drawing on under-used archival materials, this paper

will shed light on the process of translation at the Russian court, and consider how that process shaped knowledge transfer.

Session Title: Translating How To

TRANSLATION, REPLICATION, AND STANDARDISATION IN THE CAREER OF CHARLES DUFAY (1698-1739)

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Abstract

The career of the French experimenter Charles Dufay (1698-1739) illustrates three features of early modern translations of how-to knowledge. Firstly, translations changed not only the translated text but also the translator. Dufay's translation of Filippo Buonanni's "Trattoto sopra la vernice" (1720) was one of his earliest scientific projects, and it had a major effect on his later career. It eased his entry into the Parisien Académie Royale des Sciences in 1723; it also introduced him to materials (such as gold leaf and dyestuffs) and practices (such as the importance of chance events in experimental research) that reappeared in his mature research on electricity and textile dyes. Secondly, the recovery of ancient practices went hand-in-hand with the discovery of foreign practices. In his youth Dufay used his father's extensive library to study decorative arts practiced by the ancients; in his mature years he used the resources of the French East India Company to codify the Indian art of printing on cotton. Thirdly, the translation of words overlapped with, and sometimes relied upon, the "translation" of units, materials and experiments. Buonanni's text was an exercise in import substitution, a search for a European equivalent of Chinese varnish or "chiaram." Dufay's translation of the text overlapped with his search for French substitutes for Buonanni's materials, his attempts to replicate Buonanni's experiments, and his search for the French equivalents of English weights and measures. Similar points hold for Dufay's translations of writings on electricity by Francis Hauksbee and Stephen Gray. In that case, there are discrepancies between Dufay's translations and the English originals that betray his distinctive view of electrical conductors and non-conductors.

Session Title: Translating How To

PHILOSOPHICAL TRANSLATIONS: HENRY OLDENBURG AND TRANSLATIONS IN THE EARLY *PHILOSOPHICAL TRANSACTIONS*

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Abstract

Henry Oldenburg was a founding fellow of the Royal Society of London, and served as its secretary from 1660 until his death in 1677. Oldenburg is best known for his correspondence, in large part undertaken professionally in his role as secretary of the Society, and for the journal he founded, the *Philosophical Transactions.*

Oldenburg's issues of the *Transactions* are notable for containing letters, essays, observations and experiments from scholars across Europe, drawn from his correspondence. Less well known is the extent to which such items have been silently edited, abridged, paraphrased and translated by Oldenburg. The result being that a significant part of early-modern science was read—and often still is read—through the prism of Henry Oldenburg's translations.

As secretary of the Society, Oldenburg was not only a communication hub for European scholars, but via his *Transactions*, a means of communication: articles in the *Transactions* provided a key space and linguistic framework for the national and international communication of scientific ideas in the late 17th century. As the model for an academic journal, Oldenburg's *Transactions* had a massive impact. However Oldenburg's translations, his language and style, have also had a significant impact. Oldenburg's concise English versions of Antoni van Leeuwenhoek's many microscopical observations, for example, have effectively superseded the Dutchman's lengthy, complicated letters. Once published in the *Transactions*, Oldenburg's translations of Leeuwenhoek were subsequently translated into French, German, Latin, and even back into Dutch; here, as in so many cases, the language of 17th-century scientific news came from Oldenburg's pen.

This paper will introduce Henry Oldenburg as a linguist and translator, giving examples of his method. I will also look at the *Philosophical Transactions* as a repository of scientific translations, and the role of these translations in the exchange of ideas in early modern science.

Session Title: Translating How To

TRANSLATING NAVIGATION IN THE SIXTEENTH CENTURY

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Abstract

Starting from quite modest beginnings in the early sixteenth century the technical literature on navigation, nautical science and seamanship grew in a few decades to become a large body. The contents of these works were varied: basic notions of cosmography and astronomy, practical rules of navigation, descriptions of the construction and use of instruments, fundamentals of calendar-reckoning, numerical tables, technical diagrams, rudimentary maps. Since their readers (pilots, seamen, cartographers) were untrained in Latin nautical books were always written in the vernacular and their diffusion in Europe was directly connected to the production of translations: Pedro de Medina's well known *Arte de Navegar* (1545) was translated to French (at least fifteen editions), to Dutch (five editions), to Italian (three editions) and to English (two editions). Different nautical traditions as much as national susceptibilities, however, frequently created unexpected difficulties. A close reading of sixteenth century nautical books clearly reveals many of the issues connected with the translation of practical knowledge: the sometimes subtle interplay between linguistic obstacles and semantic ambiguities, national practices and national pride, and the complexity that arises due to the different understanding of the same task or the same activity.

Session Title: Translating How To

JAN BAPTISTA VAN HELMONT AND THE DIFFICULTIES OF USING HIS MEDICAL RECIPES

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Abstract

Jan Baptista van Helmont (1579-1644) is one of the most influential physicians when it comes to implementing the use of chemistry in medicine in the seventeenth century. This new branch of medicine, iatrochemistry, based on Paracelsian medicine, cures diseases by treating specific parts of the body – instead of an imbalance of the four humours – with medicines often prepared via chemical procedures.

Van Helmont wrote most of his works in Latin, although he also wrote a short version of his medical works in Dutch. His Latin *Opera omnia* was published in seven editions throughout the seventeenth century, and many translations appeared, into English, French and German. However, how easy could his texts be put into practice? Most parts are highly theoretical and the descriptions of preparations of drugs seem often incomplete. How did seventeenth-century practitioners deal with this problem?

One way to investigate this is to look at the translations that were made of Van Helmont's texts. Did the translators actually translate the practical information? Were they interested in the practical Van Helmont? And if so, what and how did they translate Van Helmont's medical recipes? To answer these questions, this paper will focus on Van Helmont's cures of the plague, which he described in both his Dutch and Latin texts. It will become clear that translators had their own reasons for translating Van Helmont, varying from political to religious and medical reasons. This obviously influences their valuation of practical information of medical recipes and makes it all the more interesting to see how the personal skills and experience of the translators got transferred into their translations.

Session Title: Translating How To

A PEDAGOGIC PROJECT FOR A 15TH CENTURY COURT: MICHELE SAVONAROLA AS SELF-TRANSLATOR

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Abstract

The production of the academic and court physician Michele Savonarola (1385-1466) changes in quantity and quality when he moved from Padua to Ferrara and from a strictly academic context to a courtly one. Latin medical treatises only are written in Padua; Latin, in double redaction (Latin and Italian vernacular), or just vernacular works which also deal with historical, ethical-political and religious subjects in Ferrara. Many of Savonarola's vernacular works – e.g. on dietetics, pregnancy, plague, gout, grape-spirit – have indeed a Latin counterpart to be found in his academic production. This quite unique feature, an ideal situation that only occurs when the bilingual author becomes a "translator of himself", provides the historian with a wonderful perspective over the transmission of knowledge and the relation between different languages, types of sources and audiences within the mind and the environment of a single individual. This paper stresses the importance of interrogating Latin and vernacular traditions simultaneously. By examining Savonarola's pedagogic project for the court, it demonstrates that vernacularisation does not always mean popularisation, simplification or the "dumbing down" of intellectual content. Savonarola's project is clearly inspired by the powerful pattern of the philosopher-counsellor proposed by the Pseudo-Aristotelian *Secretum secretorum* and by the idea of practical and active knowledge that it conveyed. Consequently, the equation between vernacular and divulgation is definitely not as simple as it looks.

Session 20

TRANS-CULTURAL AND TRANS-NATIONAL COMMUNICATION OF SCIENCE AND TECHNOLOGY - THE EXCHANGE OF SCIENCE AND TECHNOLOGY BETWEEN EUROPE AND CHINA IN THE 17th AND 18th CENTURIES

Organizer: Prof. Dr. Tian Miao

Institute for the history of Natural sciences, Chinese Academy of Sciences

From the end of the 16th century, the direct exchange of knowledge between Europe and China flourished and is well documented. European science and technology was brought into China by European missionaries, and European scholars and scientists also paid more attention to Chinese culture. This whole process of the exchange of science and technology between Europe and China can be understood as a process of communication, not only among the different groups of participants involved - Jesuit missionaries and the Catholic Church, European transmitters and their Chinese students, Chinese advocates of European science and traditional Chinese scholars, etc. - but also the communication of scientific and intellectual ideologies from very different culture traditions. Our symposium will present five case studies to investigate models of this communication.

Session 20: Trans-Cultural and Trans-National Communication of Science and Technology - the Exchange of Science and Technology Between Europe and China in the 17th And 18th Centuries

G. W. LEIBNIZ'S INTEREST IN TECHNOLOGY AND KNOWLEDGE IN CHINA

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Before and during the 17th century, missionaries acted as the main conduit for communication between Europe and China. Therefore, their impressions of China exerted a considerable influence on opinions about China in Europe. The meeting of Philippus Maria Gramaldi, a missionary, and Gottfried Wilhelm Leibniz in Rome in 1689 can be regarded as a case of communication between China and the West. Leibniz presented 30 questions to Grimaldi about China, which reflected his interest in China. Among them, 18 questions were related to technology, which show that he already had some idea of Chinese traditional technology. He also paid much attention to the unique resources of China, especially those that could have practical use in Europe. As to Chinese books and language, Leibniz's attitude represented what European people thought of Chinese science and culture. With these questions, Leibniz not only sought to confirm the knowledge he already had about China, but also to acquire new information. It closely correlated with his opinion about the origin and interaction of knowledge in Europe and China, which he emphasized many times. As to his questions, Grimaldi answered some of them according to what he knew. This shows the range and depth of missionaries' understanding of science, technology and culture in China; it also reflected the limitations of the missionaries in this process of communication.

Session 20: Trans-Cultural and Trans-National Communication of Science and Technology - the Exchange of Science and Technology Between Europe and China in the 17th And 18th Centuries

THE TRANSMISSION OF GALILEO'S MECHANICAL THEORIES IN CHINA IN THE 17th AND 18th CENTURIES

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Galileo's mechanical theories raised serious controversy in the European scholarly world, and played an important role in the establishment of early modern science. Some of these theories, such as those concerning floating and falling bodies, trajectory, strength of materials, the pendulum, as well as the telescope, observatory results through use of the telescope and new astronomical theories, were transmitted into China by one group of Galileo's European adversaries, Jesuit scientists. Interestingly, such theories did not lead to intense debate in China, even though they also conflicted with some existing Chinese theories and some elements of Confucian ideology. Based on a detailed study of Jesuits' and Chinese scholars' works and arguments, this paper provides comparative research on the different models of the transmission of Galileo's theories in China and in Europe. I argue that the presentation of the theories was modified by the Jesuit missionaries, their ideological significance in the European context being completely deleted, and that at the same time, the Jesuits used such knowledge to criticize Chinese tradition. Chinese scholars also contributed to discussions about the ideological problems concerned.

Session 20: Trans-Cultural and Trans-National Communication of Science and Technology - the Exchange of Science and Technology Between Europe and China in the 17th And 18th Centuries

A CASE STUDY ON THE TRANSMISSION OF WESTERN FIREARM TECHNOLOGY TO CHINA IN THE 17TH CENTURY. WESTERN SOURCES FOR THE *BING LU* (*RECORDS OF MILITARY ART*)

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When, from the 16th century, missionaries began to introduce Western science and technology into China, the Chinese government and some officials paid particular attention to Western firearms. These firearms, such as the breech-loading cannon and musket, and the related mechanical knowledge required to make them, were introduced into China during the middle and late Ming Dynasty. Written by He Rubin, the *Bing Lu* (*Records of Military Art*) was printed in 1606. Chapters 11 to 13 deal with firearms, with Chapter 13 including “A Treatise on the Wonderful Gunnery of the West”. Through comparison of the illustrations and data on ballistic trajectory in the *Bing Lu* and three editions of Spanish artillery expert Luys Collado’s *Practica Manuale dell’ Arteglieria* (completed in 1586), as well as other European documents, this paper argues that the *Practica* is one of the main sources of knowledge of Western firearm technology recorded in the *Bing Lu*. This demonstrates the wide spread of western knowledge in China, and interactions involving military technology between China and the West. Based on this study, the author also provides further arguments about the cross-cultural transmission of knowledge and technology between the West and China in the 17th century.

Session 21

SCIENCE AND SATIRE: SCIENCE, TECHNOLOGY AND MEDICINE IN THE 19TH CENTURY SATIRICAL PRESS

Organizers: Katalin Straner, Markian Prokopovych

The study of the production, circulation and communication of knowledge in the public sphere has received increasing attention by historians of science, technology and medicine, as well as urban historians in recent years. This session invites participants from both fields to combine their expertise in the study of the public image of science, technology and medicine in the satirical press, and hopes to provide a platform for developing new perspectives to the study of their circulation in the public sphere. As satire and caricature became increasingly popular forms of cultural and social commentary by the 19th century, satirical representations of – for instance – controversial scientists, new scientific and medical discoveries or technological innovations and artefacts came to serve as (often visual) aids for science dissemination and popularization. Moreover, cartoons and caricatures often presented "the voice of the public" [Janet Browne, "Charles Darwin as a Celebrity," *Science in Context* 16:1 (2003), 175-194: 183], indicating a level of familiarity with scientific developments in the public sphere. Expressions of popular humor – such as articles in the urban press, caricatures, or cartoons – reflected different perceptions about the role of science and technology in society. The urban press and its audience used satire to participate in and reflect on a world otherwise limited to them, at the same time often expressing uncertainty with the rapidly growing body of new – and sometimes seen by the public as – controversial scientific and technological development and its social and cultural consequences (e.g. the popularity of evolutionary theory or new technological inventions as a source of humor). The session will thus be concerned with the satirical constructions of certain aspects of scientific and medical knowledge and technological developments communicated towards, but also created by the public: papers in the session will address, on one hand, the role of satire in the dissemination and popularisation of science, technology and medicine; and on the other, the formative effect of the urban press and its readers on the circulation of science and technology in the public sphere.

Session Title: Science And Satire — Science, Technology And Medicine In The 19th Century Satirical Press

"A DIPLODOCUS TO CHEER HIM UP". CARNEGIE'S DINOSAURS AS A SOURCE OF CRITICISM AND COMEDY

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Abstract

During the opening decade of the twentieth century, the Scot industrialist (and allegedly the richest man in the world) Andrew Carnegie donated nine copies of the dinosaur *Diplodocus carnegii* to European and South American natural history museums. Because this was essentially a marketing campaign in support of his plans for international peace arbitration, Carnegie would only consider donating these plaster copies personally to heads of state. The heads of state duly obliged, and Carnegie's employees could be seen visiting a different European country about every year, setting up his master's gift.

Bu this desire for gifts on the part of the mighty also provoked criticism - and ridicule. How could it happen that powerful rulers were seen to crawl before a parvenu, a man whose sole virtue seemed to be his enormous hoard of money? Attitudes to Carnegie in the the press, and elsewhere, remained ambivalent: while he was appreciated for his philantropism, he also remained to be seen as a parvenu, a symbol (or caricature) of all that was good and bad about the United States. It also reflected on American science: controversies around *Diplodocus* quickly took on an edge of intra-national competition, in which even the competence of American scientists was drawn into doubt.

News media were hardly immune to the farcical side of the *Diplodocus* affair, the more so since it offered some welcome yet relatively safe possibilities to criticize their own (and other) rulers. In cartoons, commentaries and the 'funnies' in newspapers on both sides of the Atlantic, *Diplodocus* quickly acquired a comical dimension which extended to all those associated: Carnegie, the 'crowns of Europe', and various scientists bickering over it.

This paper investigates the way in which *Diplodocus* was used as a tool to deliver social and political commentary. I will argue that this case can be seen as part of a tradition that uses the image of dinosaurs for satire, but also that it added new elements that have been part of the popular perception of these animals up to the present. Finally, I shall try to frame this case within the wider issue of the satirical use of scientific topics and (particularly) objects.

6th International Conference of the European Society for the History of Science, Lisbon, Portugal

Session Title: Science And Satire — Science, Technology And Medicine In The 19th Century Satirical Press

CULTURE AND ANXIETY IN NINETEENTH-CENTURY TELEGRAPH CARTOONS

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Abstract

The emergence of telegraph as a public means of rapid communication across great geographical distances was one of the important transformations of urban space in the nineteenth century. This new technological presence in the public realm increased the prominence of urban centers as hubs of communication, financial and journalistic media. As the telegraph gained visibility, it became a subject of popular culture, inspiring many cartoons, sensational journalistic accounts and fictional elements that appeared in the popular presses and detective fiction of England, Europe and America. If we examine these popular images of the telegraph closely, we find that they were ironic in ways that reflected a complex combination of public admiration and anxiety over the emergence of a new medium that, while not very well understood, was capable of gathering and transmitting personal information, often without the knowledge of its human subjects. In this paper, I will examine some of the ways in which telegraphy gained visibility in nineteenth-century urban culture and became associated with new means of recording, transmitting, and regulating human behavior.

Session Title: Science And Satire — Science, Technology And Medicine In The 19th Century Satirical Press

K. & K. TECHNOLOGY: THE HABSBURG MONARCHY, TECHNOLOGICAL NOVELTIES AND THE FIN-DE-SIÈCLE SATIRICAL PRESS

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Abstract

The attempts of the Habsburg Monarchy to present itself as a modern political and social entity provoked many critical reactions in diverse quarters of society at the turn of the century. This paper concentrates on the visual commentary on imperial modernization efforts through humorous analogies with the malfunctioning of the recently introduced technological novelties, such as trains, city trams, automobiles, airships, as well as the telephone and the telegraph, in the urban satirical press of Vienna and Budapest. The larger urban public might not have known or understood the greater implications of such technological novelties in the long term perspective, and might not even have been in a position to learn its construction and mechanisms, but it possessed first-hand knowledge of its eventual failures from street experience and from the reports in the press. The satirical press capitalized on this knowledge. In contrast to the overwhelming imperial presence at important public events such as technological and industrial exhibitions and the inaugurations of the new means of transportation, the satirical press often suggested to compare the functioning of the late Habsburg Monarchy to that of the outdated, pre-modern machinery. Similarly, the parliamentary system was likened to a crashed airship, a tram too full to take all passengers on, and to a fancy automobile stuck in countryside mud. The conflict between the workers' movement and the police reminded of two locomotives facing each other, and the relationship between the imperial court and the provinces appeared similar to a malfunctioning telephone line. While a surge of patriotism later, during the First World War, moderated such ironic and satirical allusions, the fin-de-siècle satirical press created its own public image of new technology, which was then used to criticize and mock larger problems within the Monarchy.

Session Title: Science And Satire — Science, Technology And Medicine In The 19th Century Satirical Press

THE IMAGE OF SCIENTISTS IN NINETEENTH-CENTURY HUNGARIAN SATIRICAL MAGAZINES

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Abstract

The paper will engage with the role of satirical magazines in constructing the public image of scientists, in caricatures, cartoons, and humorous sketches in nineteenth century Hungary, when satirical magazines became an important and growing element of social, political and cultural commentary in the public sphere. The question of who, in what ways, and to what purpose, constructed public images of the scientist through satire leads to other considerations, such as whether the public would accept and internalize the satirical (and often unflattering) representations of scientists (and through their involvement, potentially controversial scientific developments – for instance, the satirical representation of the proponents and critics of evolution), and to what extent the scientists could influence their public image. The paper will address the stereotype of the celebrity scientist (international or local), which was becoming a regular feature in the popular and satirical press in Britain and elsewhere, in the context of the Hungarian public sphere of the nineteenth century. Since the Hungarian satirical press was very politically oriented, the examination of the presence of scientific figures in the satirical press, including the roles assigned to scientists in political satire, can provide new perspectives on the representation and circulation of scientific ideas in nineteenth-century Europe.

Session Title: Science And Satire — Science, Technology And Medicine In The 19th Century Satirical Press

ARCTIC ICONS, SATIRE, AND SCIENCE IN LATE 19TH CENTURY CENTRAL EUROPE

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Abstract

The Austro-Hungarian Polar Expedition returned to huge welcome festivities in Vienna in 1874. Hundreds of articles and many illustrations were printed in the urban press, among them many with satirical content: these were published both in satirical journals and sensationalist newspapers and in respectable papers with a self-understanding as conveyers of scientific knowledge to a learned public. Satire in these texts and caricatures was in particular directed at well-known arctic icons such as icebergs, polar bears, and the aurora. I will argue that these icons were not only used as representations of the Arctic but also as ironic remarks on contemporary political and social life in the monarchy. Viennese media are particulary interesting in this respect as they had a significant role in negotiating and defining contemporary discourses on culture, politics and science in the monarchy. The paper will thus contribute to discussions on the interrelations between scientific and popular knowledge in the late 19th century and to the still marginal literature on the relevance of the Arctic and its phenomena in continental European culture.

A focus will be on the then scientifically still unexplained phenomenon of the aurora borealis. I propose that there were at least two main reasons for the many satirical representations of the aurora and other polar icons which can be found in the periodical press of Vienna: 1) Knowledge of the Arctic and in particular of the aurora had to rely on popular and scientific representations and not on the public's own experience, facilitating the process of applying such knowledge to topics which at the outset had little to do with the expedition and the Arctic itself. 2) Through its ambiguous role as an object vacillating between scientific knowledge and speculation, and because of its spectacular character, the aurora acquired a role as a floating signifier which could be adapted to different contexts. The paper thus attempts to show that satirical representations of objects of scientific inquiry not only helped produce and disseminate scientific knowledge, but indeed also had a formative effect on society in general.

Session Title: Science And Satire — Science, Technology And Medicine In The 19th Century Satirical Press

SEX EDUCATION IN HUNGARIAN HUMOR MAGAZINES IN THE LATE DUAL MONARCHY

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Abstract

In Hungary the turn of the century saw the emergence of various social movements that actively engaged in what we would now call sexual politics. The Hungarian feminist association (Feministák Egyesülete), the anti-VD associations (Teleia, Országos Védő-Egyesület), as well as other promoters of social hygiene and eugenics and scientific progressives around the journal Huszadik Század and the Társadalomtudományi Társaság (Social Science Association) were all discussing biological and "scientific" solutions to contemporary social problems. In the early 1900s many believed that sex education, that is, the "scientific" enlightenment of youth on sexual matters would provide an answer to the pressing sexuality-related issues, most importantly: masturbation, venereal disease and prostitution. Many believed that these social evils (as well as the solitary vice) needed to be addressed at an early age. The budding sexology movement maintained that sex could be analyzed in a scientific manner and that with proper research one would arrive to a universal theory of sexuality. Sex education both for children and for young adults was seen as a way to win this crusade in the long run, opening the eyes of the ignorant masses by lifting the veil with the help of knowledge (and without being pornographic in any way). Thus, it was believed that there was a proper, (healthy and frank) way to discuss sexuality - the debate being what actually needed to be said if educators wanted to do this in accordance with the teachings of science. The peak moment of this discourse was the major sex education conference in 1907-1908 in Budapest, organized by Ferenc Kemény, an internationally-renown expert of sex education. In the contemporary Hungarian satirical magazines (e.g. Fidibusz and Magyar Figaró), well-known for their lascivious humor, these views on sex education were a natural source for jokes. These magazines, as a great deal of their humor was based on a mockery of sexual norms/morals, showed keen interest in the sex education movement and one can find ample cases of caricatures on the "scientists of sex." In this paper I will analyze the depiction of sex education movement in Hungarian satirical magazines, ca. 1900-1918, to take a glimpse at the representation of the anxieties of the urban middle class (the target group of both sex educators and these magazines) in connection with sexual knowledge-production.

Session Title: Science And Satire — Science, Technology And Medicine In The 19th Century Satirical Press

‘DEATH IN THE XXTH CENTURY’: DARK HUMOR AND THE INTRODUCTION OF BICYCLES, AUTOMOBILES, AND AIRPLANES

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Abstract

At the turn of the twentieth century, many people first encountered the new transportation technologies of the day such as bicycles, automobiles, and airplanes through the popular press, where darkly humorous images and stories at times perpetuated or exacerbated fears about their dangers. Journalists and illustrators often likened the novel machines to animals in order to tease out their salient differences or connected them to traditional symbols of death, such as the Grim Reaper, to highlight their dangers. In both cases, journalists and illustrators relied on seemingly familiar symbols to lampoon and popularize new technology. Drawn primarily from the Polish popular and specialist press, this paper will explore several examples of humor and especially dark humor regarding bicycles, automobiles, and airplanes. The paper will consider similar examples from other parts of the world, arguing that such humor was generally an interurban and global phenomenon – a common reaction to the dangers and delights of powerful new machines.

Session 22

HISTORY OF CARTOGRAPHY: CHARTS, MAPS AND GLOBES IN EARLY MODERN EUROPE

Organizer: Joaquim Alves Gaspar

Maps are, and have always been, a privileged mean to conveying geographical knowledge. And the conception, circulation and use of maps is an important component, albeit seldom referred to, of the intellectual process that led to what we call today the Scientific Revolution in Europe. With this symposium, which is focused on the early modern period, we propose the History of Cartography to become a more permanent component of mainstream research in the History of Science and Technology.

Session title: History of Cartography: Charts, Maps and Globes in Early Modern Europe

BEYOND GEOGRAPHY AND CARTOGRAPHY. THE RECEPTION OF PTOLEMY'S GEOGRAPHY AND THE INVENTION OF NEW FORMS OF REPRESENTATIONAL SPACE THROUGH GEOMETRIC DIAGRAMS AND FIGURES IN THE FIFTEENTH CENTURY

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Abstract

Recent studies of the overlooked Venetan critical reception of Ptolemy's Geography in the first half of the fifteenth century, at the intersection of different cultural milieux ("gente di mare," magistri of the university, monastic culture), enables to highlight innovative forms through which the science of Antiquity was integrated and re-formulated into fifteenth-century culture and scientific practices.

Following these footsteps, this paper focuses on a so-far "forgotten" Venetian codex prepared between 1430 and 1450 that transmits and translate in the Venetian vernacular the so-called theoretical parts of Ptolemy's Geography and adapt them, for the first time, to the much larger mid-fifteenth-century imago mundi through a unique integration of mappae mundi, marine charts, and graduated grids. Through a close reading of this source, the paper addresses and analyses the little known, still crucial, role of Ptolemy's Geography with respect to three major topics:

- the creation of new forms of representational space (beyond the so-called "Ptolemaic projections") through diagrams, geometric figures, and various forms of maps, mutually linked one to the others;

- new forms of distribution and articulation of images and text to structure scientific discourses;

- the functions of images as tools to better articulate and show the links between the "general" or "universal" and the "details".

This analysis will show a remarkable extension of the functions and relevance generally assigned to Ptolemy's Geography – beyond geography, cartography and cosmography – as a scientific text that provides the intellectual backgrounds and mental structure on which geometric images could assume independent persuasive and argumentative functions with respect to the written text, playing a crucial role in the early modern processes of mathematization and transformation of nature.

Session title: History of Cartography: Charts, Maps and Globes in Early Modern Europe

TO PRAISE, AND YET TO MODIFY: THE RENAISSANCE RECEPTION OF PTOLEMY'S GEOGRAPHY

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Abstract

The Geography of Claudius Ptolemy, written in Alexandria in the second century AD, was perhaps the most important cartographic work of classical antiquity. It was lost during the middle Ages, and its rediscovery in Europe in the fifteenth century caused a great intellectual fervour among all scholars interested in geography and cartography: humanists pored over the book and praised it highly, and many manuscripts and printed editions were produced. At the same time, scholars recognized that Ptolemy's data was out of date, and that the coastal outlines on medieval and Renaissance nautical charts were much more accurate. So both scholars studying the Geography and editors preparing it for publication employed various strategies to modify and supplement Ptolemy's maps and text. In this paper I will examine some of those strategies, including modifications of Ptolemy's coastlines, *tabulae modernae* added to Ptolemy, and contemporary annotations in printed editions of the book.

Session title: History of Cartography: Charts, Maps and Globes in Early Modern Europe

INNOVATION IN THE NAUTICAL CARTOGRAPHY OF THE RENAISSANCE: THE IBERIAN CONTRIBUTION

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Abstract

Two events are usually considered as the most significant in the history of nautical cartography: the construction of the first portolan charts, in the beginning of the thirteenth century; and the presentation of the Mercator projection, in 1569. A major difference separates these two cartographic models: while the first is constructed using the magnetic directions and estimated distances between places collected by the pilots at sea, the second is based on geographical coordinates – latitudes and longitudes. A hybrid model not usually acknowledged as such in the specialized literature is the 'latitude chart' (or 'plane chart'), which is based on observed latitudes and magnetic directions. This was the solution adopted in nautical cartography from the beginning of the sixteenth century on, following the introduction of astronomical navigation. Due to the limitations imposed by the navigational methods of the time, the latitude chart was only abandoned at about 1750, when the longitude problem was finally solved and the Mercator projection was fully accepted by marine navigation.

This paper is focused on the technical evolution of nautical cartography from the last quarter of the fifteenth century, when astronomical navigation was introduced, to about the end of the first quarter of the sixteenth, when the large planispheres of the Casa de Contratación were constructed. Two particular aspects are analyzed: the transition between the portolan chart and the latitude chart; and the use of multiple latitude scales. It will be shown how the errors introduced by magnetic declination and the inconsistencies caused by the implicit assumption of a flat Earth have affected the geometry of the charts, and how cartographers and pilots responded to the problems..

Session title: History of cartography: charts, maps and globes in early modern Europe

MANUSCRIPT COPIES OF RENAISSANCE MAPS AS SOURCES FOR THE CIRCULATION OF CARTOGRAPHIC KNOWLEDGE

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Abstract

Renaissance maps can often provide good historical sources for the circulation and communication of cartographic knowledge. The paper will give an introduction into this topic, looking at three particular contemporary settings, where maps were drawn in the Early Modern Period for didactic purposes.

First, we present some little-known manuscript maps, which are based on Ptolemy-Prints (Ulm, 1486, and Strasbourg, 1513) – among them the maps we can find in the "*Kollegienbuch*" of the German Cosmographer SEBASTIAN MÜNSTER (1488–1552) and also unique maps, which were drawn after Ptolemy by the circle of people around the Swiss Humanist JOACHIM VADIAN (JOACHIM VON WATT; 1484–1551).

Second, the famous world map of the German Cartographer MARTIN WALDSEEMÜLLER (c. 1475–1520) of 1507 is another example for the circulation of knowledge in Early Modern Europe. It probably also was used for teaching geography. This can be seen in contemporary manuscript-copies, made by SEBASTIAN MÜNSTER and the Swiss Humanist HEINRICH LORITI (GLAREAN, 1488-1563), who has also written the "*Geographia Liber Vnvs*" in 1527.

Finally, the paper will deal with the so far unknown "*Repertorivm in Formam Alphabeticam*" (1519), a geographical dictionary compiled by Dr. JAKOB STOPEL († 1535) from Memmingen, Swabia/Germany, which contains more than 8.600 geographical coordinates of regions, towns, waters and mountains. The detailed analysis of the scientific network in which STOPEL worked offers new insights into the Humanism in German monasteries of this time. The paper will discuss the cartographic sources of the tables of coordinates, which include the location of places in the New World, remarkable information for this time period. So it will be shown that cartographic knowledge circulated overall Europe in the Humanism as part of teaching cosmography.

Session title: History of Cartography: Charts, Maps and Globes in Early Modern Europe

SYNTHESIS, INNOVATION AND CIRCULATION: ROBERT DUDLEY'S CARTOGRAPHY IN THE ARCANO DEL MARE 1646- 8

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Abstract

The Arcano del Mare (1646-48) took Robert Dudley (1574 -1649) over 12 years to compile, edit and publish. It included (Book 6) the first sea atlas of the world with charts constructed on the Mercator projection, and on which winds, currents and magnetic variations were recorded. Although the atlas volume has long been recognised as important, studies of it have usually been confined to the cartography of the coasts of the world of special interest to the various commentators. But more general questions remain. How did Dudley actually construct his charts? What were his sources for the co-ordinates of places, for the geography and toponomy of the coasts and islands? How did he put the atlas together and did contemporaries and later practitioners use or value it? Working with over 300 extant manuscript drafts and other charts and journals collected or used by Dudley, some of these questions can now be answered and the cartography re-assessed.

Session 23

IBERIAN SCIENCE IN CONTEXT AND ITS NETWORKS OF CIRCULATION

Organizer: Antonio Sanchéz, Emma Sallent Del Colombo

The Iberian world of early modern period generated a significant diversity of new information on ocean navigation, natural world and cosmography. This information circulated by complex networks of knowledge from Seville and Lisbon to Goa and New Spain, among many other distant places. The operation of these networks and the information circulated by them remains today a very fertile field of study for historians of science. In this sense and given the growing historiographical interest that are taking the Iberian studies, this symposium draws attention to the scientific activity in the Portuguese and Spanish world in the fields of cosmography, navigation and natural history during the early modern age - XV, XVI and XVII centuries. The main objective is to highlight through individual case studies the scientific contribution of the Iberian societies during early modern that allow us a better and more complete understanding of the European history of early modern science in a global perspective.

This initiative could materialize for the first time in the 24th International Congress of History of Science, Technology and Medicine held last June in Manchester with a symposium about early modern Iberian science entitled: “Visual, material and empirical culture in early-modern Iberian science”. There, with this broad title, we intended to present the wider community of historians of science the latest research in the field of the history of modern science about the activities and scientific practices developed in Spain and Portugal in the early modern age, almost always linked to the geographical discoveries and the expansion era. Our purpose was to put the latest research by historians of science in a new historiographical context concerned Iberian studies of science, circulation of knowledge and the Atlantic world in imperialist context.

This symposium will focus on networks of circulation and communication of nautical, cosmogrphical and naturalistic knowledge. Participants at this symposium will discuss topics with new theoretical approaches from studies of visual and material culture of science, as well as the emergence of empirical knowledge and craft of early modern times. These approaches will also allow us to rethink what was the role played by Portuguese and Spanish humanist, scholars, practicioners or artisans in the broader context of the early modern science. These studies will discuss and shed more light on how, where and under what conditions scientific knowledge was produced in the preliminary stages of the early revolution of the European sciences in an transoceanic perspective.

Formally, this symposium consists of three sessions made up of three or four papers. One session will be dedicated to visual culture and natural history. Another session will be devoted to navigation and material culture. And another session will be dedicated to cosmographical practices and artisanal knowledge.

Session title: Cosmographical, Nautical and Astrological Practices in Portugal and Spain during the 16th and 17th centuries

TRANSMISSION OF NAUTICAL AND COSMOGRAPHICAL KNOWLEDGE IN 16TH AND 17TH CENTURIES: THE CASE OF PEDRO NUNES

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Abstract

This communication aims to evaluate the transmission of the ideas and of the work on navigation carried out by the cosmographer and mathematician Pedro Nunes.

It is known that the texts he had published in 1537 and 1566 had a good acceptance and were acknowledged among erudite circles of Europe. However, due to the theoretical nature of these texts and because they were mostly written in Latin, historiography raised questions about its real impact and diffusion amongst the less lettered, particularly in what regarded pilots and other practical professions.

These questions led to issues that had to be clarified in order to better understand the impact of the work of Nunes on of the navigation and seamanship of his time. My investigation sought to evaluate the existence of evidence of such transmission; acknowledge what channels, mechanisms, contexts and people that were responsible for these phenomena, to investigate the kind of knowledge that was disseminated, transmitted and assimilated, and even estimate the extent to which the scientific contributions of Pedro Nunes were integrated in the practice of sailors.

Two paths of investigation were followed in order to answer these questions. The first focused on the evaluation of the direct action of Nunes as a cosmographer. Only a few records have survived from this performance. Nevertheless, with the identified evidence and new sources, it was possible to build a more complete image of the impact of his activities. The second path sought to assess in what extent and how the ideas, techniques and results of Pedro Nunes were embedded in the work of others - namely in the work of cosmographers, navigation teachers and mathematicians - and in what contexts of practical cosmography and educational settings (principally) in Portugal, Spain and England during the sixteenth and seventeenth centuries.

Session title: Cosmographical, Nautical and Astrological Practices in Portugal and Spain during the 16th and 17th centuries

PORTUGUESE MARINERS AND THE EXAMENES DE PILOTOS AT THE CASA DE LA CONTRATACIÓN, 1508 - 1600

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Abstract

The Examenes de Pilotos, or Pilot Examinations, are a series of documents held at the Archivo General de Indias in Seville, Spain, that record a large number of applications for seamen who wished to obtain the grade of pilot from the sixteenth to the eighteenth centuries. While much is known about the process of teaching and licencing of pilots in Spain, little has been said on the examinations themselves. They form an important part of the system of knowledge transfer between Portugal and Spain, as well as Iberia and northern Europe, in the sixteenth century.

This paper examines the importance of pilot-training and examining as a medium of knowledge-transfer and assesses the role of Portuguese seamen in Seville in the sixteenth century in the context this training and licencing. It traces the development of nautical teaching from the creation of the position of Piloto Mayor, or Chief Pilot, in 1508 to the establishment of a class mid-century dedicated to formal instruction for aspiring pilots, and assesses the demographics of the recorded exams and licences, with particular reference to Portuguese applicants. It examines a number of individual Portuguese examinations and draws comparisons with those of native Castilian applicants. It also assesses whether the Portuguese applicants can be counted as a separate category of 'foreigner', or whether they belong with all the other non-Castilian applicants. Finally, it asks whether Iberian Union in 1580 could have made any difference to the prospects of the Portuguese applicants.

Session title: Cosmographical, Nautical and Astrological Practices in Portugal and Spain during the 16th and 17th centuries

CREATING A NEW ASTROLOGY FOR WIDE AUDIENCES. CONTENTS AND AIMS OF POPULAR WORKS DESCRIBING THE NEW WORLD.

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Abstract

After the first descriptions of the lands of the New World arrived to Europe, and when the priorities of navigation routes, cartographic information and natural history richness were settled, some of the inhabitants of the New Spain and of the viceroyalty of Perú who were interested in astronomical and astrological knowledge published books claiming for the need of an astrology specific of those new lands. The aim of this paper is to make an analysis of the contents of a few of those works, that takes into account not just nationalist claims and debates within the societies of México and Perú, which have been the focus of previous studies, but also the weight of the audience they were addressed to within those societies in their constitution. For instance, the popularity of the astrological *Repertorio* (1606) by the cosmographer at the service of the Spanish Council of Indies Heinrich (or Henri) Martin (signed as Henrico Martínez), when compared with the more scholar work by the physician Diego Cisneros (*Sitio…* 1606), allows a study with such a perspective. Another case is that of some works published in Lima, the *Astrology in medicine* (1660) by the Portuguese physician Joan de Figueroa as compared to the traditional chronicle by the Augustinian friar Antonio de la Calancha (1639), who considered that by that time the influences of the constellations of the new sky over the lands of Perú had not been established yet. They wanted to create an astrology for the new lands, following the tradition of astrological European knowledge, but they produced their works for different audiences, still arguing against the contents of the works of others.

Session title: Cosmographical, Nautical and Astrological Practices in Portugal and Spain during the 16th and 17th centuries

SCIENCE BY REGIMENT: PORTUGUESE COSMOGRAPHICAL PRACTICES IN THE SIXTEENTH AND SEVENTEENTH CENTURIES

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Abstract

The Iberian World of the overseas expansion generated a series of normative documents associated with cosmography and navigation that are of the most substantial historical and epistemological significance. After the first years of ocean explorations, both Spanish and Portuguese monarchies established standards to control the production and the validation of scientific knowledge. The methods used by both to directly intervene in the nautical and cartographic practices were often similar, but not the same.

This paper examines one of these documents, the *Regimento do Cosmógrafo-Mor* (the *Regiment of the Chief-Cosmographer*), an anonymous treatise written in 1592 which is an update of a previous and not extant regiment of 1559. This type of texts, typical in Portugal during the period of geographical discoveries, set out the rules and precepts to a specific career and professional occupation, as the cosmographers and pilots. The *Regimento* contains a set of statements that regulated Portuguese navigation and cartography in the sixteenth century, but also includes practical guidelines for nautical astronomy, for the production of charts and nautical instruments, and more specific procedures like nautical teaching.

Albeit the existence of other similar regiments regarding other topics such as the *Regimento do Físico-Mor* of 1515 (regiment for the Chief Physician) or the *Regimento do Cirurgião-Mor* of 1631 (a regiment for the Chief Surgeon), this document is an unprecedented testimony of organizational, technical and educational strategies for the cosmography of the Age of Discovery. The *Regimento* is the first known document that provides exhaustive information on the teaching and training of seamen in Portugal during the sixteenth century, as well as on the role played by the Chief Cosmographer in this context.

Session title: Networks and Spaces of Circulation in Early Modern Iberian Natural History

"IBERIAN SCIENCE" IN THE METALLOTHECA VATICANA. GATHERING AND DISPLAYING IBERIAN *MINERALIA* IN 16TH CENTURY ROME

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Abstract

The 16th century was a period when knowledge about minerals was expanding. The rediscovery of ancient knowledge about stones and fossils at the same time as the discovery of new mines in the Old and New World lead to growing interest in this field. Ores, fossils and minerals found their place in private natural history collections, whereas specific treatises were written on this subject. Although the German territories held a leading position in this respect, the Third Kingdom also became object of interest in Italy and the Iberian peninsula. Minerals took their place as an integral part in the wider enterprise of collection and display of natural knowledge within the papal and the Iberian courts. The production of books on minerals were supported by the Popes, by the Kings, and the Viceroys, information on the third natural kingdom was in demand from all around the world, mineral *specimina* were included in the court collections, and in the case of Rome, a real *Metallotheca Vaticana* was created in the 1570s by the papal doctor Michele Mercati (1541-1593).

The paper aims to analyze the way "Iberian science" was present and displayed in this collection and how Iberian powers and the Papal State interacted, collaborated, and struggled in the production of a scientific knowledge about minerals. First, I will enquire into the different practical and epistemological choices that dictated the collection of Iberian *specimina* and information about minerals, the various types of circuits that were set into motion for this purpose (scientific, diplomatic, administrative, religious...) and how actual acquisition occurred. Particular attention will be devoted to the various actors involved (patrons, scholars, ambassadors, artists…) who played an essential role both in the collection of objects and information, and in elaborating and transmitting the knowledge connected to these. Second, I will consider how Iberian *mineralia* fit into the larger context of the *Metallotheca* project and into the particular conception of the world and nature that lay behind Mercati's modes of collecting and representing mineral knowledge.

Session title: Networks and Spaces of Circulation in Early Modern Iberian Natural History

CRISTOVAO DA COSTA's *TRACTADO DE LAS DROGAS*: THE TESTIMONY OF A SINGULAR MAN

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Abstract

Since the first half of the 16th century, the botanical illustrations conquered its relevance in European floras and compendiums of *materia medica*. Whenever possible, plants were painted from life. Nevertheless, the great difficulty for the artists to have direct access to plant specimens from distant regions led many Europeans to rely on oral and written reports transmitted by travelers, missionaries and merchants. Hence those graphical representations of tropical plants remained frequently a fictionalized representation.

Despite of the compelling value of *Colóquios dos Simples* (Goa, 1563) of Garcia de Orta (c.1500-1568) for the circulation of a revised knowledge about the Asian natural resources, the first images of nature from the East only arrived in Europe in the last quarter of the 16th century. Registered by the Portuguese physician Cristóvão da Costa (c.1525-1594), these plants were drawn from life during his Asian travels; the woodcuts were included in the *Tractado de las drogas* he published in 1578, in Burgos. Costa's work combined, for the first time, words and images to describe the spices and drugs of the Orient outlined by an eyewitness.

During this communication we will contextualize the appearance of this treaty and clarify the relevance of these two forms of discourse - textual and graphic - in the description of Imperial natural resources.

Session title: Networks and Spaces of Circulation in Early Modern Iberian Natural History

ILLUSTRATING THE MARVELOUS: IMAGES OF NEW WORLD'S NATURE BETWEEN CENTERS AND PERIPHERIES

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Abstract

This paper aims to contribute to the discussion about circulation and communication of New World's natural historical illustrations and also to stress the importance of these visual representations for the formation of early modern empiric science.

Attention will be paid not only to centers where these "exotic" images were created primarily (especially Iberoamerican World), but also to "peripheries", where were disseminated. More specifically, the paper will be also focus on the reception and interpretation of the "marvelous illustrations" in the Central European environment (Prague, Wien, Krakow etc.). The study tries to reveal the process of exchange and circulation of "exotic" natural historical images in networks of naturalists (P. A. Mattioli, T. Hájek of Hájek, A. Huber of Riesenpach, G. Handsch, J. Camerarius or S. Syrenius); on the second hand illustrates the incorporation of new naturalistic images into the non-scientific context (art, travel reports or everyday life).

The reception and interpretation of Iberoamerican knowledge and pictures will be examined through particular case studies, which will lead to comparison of New World's nature illustrations (as well as connected commentaries) proceeding from "centers" and "peripheries".

Session title: Networks and Spaces of Circulation in Early Modern Iberian Natural History

OVIEDO'S "BIRD WITHOUT A NAME". THE CHALLENGE OF *EKPHRASIS* IN EARLY MODERN NATURAL HISTORY

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Abstract

Departing from the notion of *ekphrasis*, this paper examines the tension between natural objects and their textual descriptions, as published in early modern natural history treatises. It centres on one particular example taken from Gonzalo Fernández de Oviedo's *Historia General y Natural de las Indias*: the description of a curious bird which neither Oviedo nor his informant, Andrés de Urdaneta, can name. The story of this bird –in the paper we show it to be a bird of paradise– illustrates both the limitations and challenges of textual description with regard to the understanding of early modern *naturalia*, particularly the rare and unknown. This example also illustrates the naturalist's own concerns regarding these limitations and challenges, specially in those cases where the sensory aspects –tactile, visual– are central to the specimen's description and characterisation.

Session title: Communicating Medicine and Natural History Through Visual, Textual and Material Culture

RETHINKING SPACES AND CONTEXTS OF IBERIAN SCIENCE: MISSIONARY NATURAL HISTORIES AND WORLD-CITIES

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Abstract

In the early decades of the 17th century, Spaniard and creole Franciscans and Dominicans, as Gregorio de Bolivar and Pedro de Aloysa, shared a strong interest in natural history, while pleading for urgent reformation of the local Church in Perú. They explored unknown regions of the Virreinato del Perú for more than 20 years and also lived in different cities, such as Lima and Potosi, enjoying the possibility to temporary come back to Europe, all along with their works on the missionary field. Bolivar´s journey – far to be completely retraced - spanned from Rome to Madrid. In both these capitals, he had, between 1625 and 1626, the possibilities to unfold his naturalistic and cartographical experience, either within the Congregation of the Propaganda Fide or at the royal court.

However, full acceptance and validation of knowledge coming from the missionary fields seem to have hardly been an easy matter due to the interplay with the complexity of the contexts of reception, entailing two different and mutually competing world cities, such as the city of the pope and the capital of the Spanish Empire and their multiple relationships and tensions.

The paper sets out to investigate the production and circulation of missionary natural histories across the Atlantic, although they never got to be published and they can only be retraced in fragmented forms. By investigating untapped materials, it will provide an original contribute to the collective attempt to re-define the historiographical context concerning Iberian studies of science, by questioning the conceptual framework of the area-studies.

Session title: Communicating Medicine and Natural History through visual, textual and material culture

SNAKES OF THE NEW WORLD: DESCRIPTIONS OF OPHIDIANS IN THE SIXTEENTH-CENTURY PORTUGUESE AMERICA

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Abstract

Although the main motivation for the colonization of the New World was the exploitation of the native genres and precious metals, which had great commercial value, the effective European settlement of South America only became possible with the recognition of the characteristics of its tropical nature. As they entered in the Atlantic Forest biome, the chroniclers, clerics and European settlers endeavored to catalog and describe the numerous and unknown species of fauna of the newly discovered territory. Among these various animals, snakes have a prominent role in the descriptions of the Europeans.

Watched in amazement, the snakes genera *Micrurus sp.* and *Crotalus sp.* caused astonishment by the lethality of their venom. Large snakes, such as the family Boidae, which still did not possess venom, aroused the fear of the settlers because of its constrictor attack, which choked and fractured bones of their prey. Their advantaged physical proportions, however, offer opportunity for its use as a food source, to the astonishment and protest some chroniclers, due to the fact of snakes are, according to the Aristotelian tradition, lower animals that could arise spontaneously in the middle of compounds putrefying.

Finally, describe the existing snakes in the Atlantic Forest of the sixteenth century, was a key strategy in establishing a colony in the New World. Beyond what could be shipped and marketed in the metropolis, the descriptions of snakes help us to understand how the chroniclers, clerics and European settlers recognized and warned against the dangers of the natural world of Portuguese America.

Session title: Communicating Medicine and Natural History through visual, textual and material culture

THE MEDICAL AND NATURAL SCIENCE IN THE PORTUGUESE MONASTIC LIBRARIES: CATALOGUES, BOOKS AND READERS

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Abstract

The aim of this paper is to investigate the presence of books on natural history and medicine in the old monastic libraries in Portugal. The research for this paper is part of a larger research project on the acquisition and circulation of scientific books within the religious orders in Portugal in the 15th-18th centuries.

An analysis of extant library catalogues/inventories of the major religious orders is currently under way. Library catalogues provide a rich and important source of information, but an examination of the exemplars is also necessary to reconstruct reading practices. It is not an easy task, due to the drastic suppression of all the orders dated, in Portugal, 1834. Nowadays only some of these "surviving items" are preserved in the Portugal's Archives and Libraries.

The main purpose of this paper is to show which medical books and books on natural history and which authors were most widely available in Portuguese ancient monastic libraries. Exploring the catalogues it is possible to identify an essential *corpus* of texts which enlightens the diffusion and the impact of these books in Portugal. But also, in this paper, is considered the topic of fruition of this class of books in monastic context in an effort to stress its importance in relation to the scientific practices of each of the different religious congregations.

Session title: Communicating Medicine and Natural History through visual, textual and material culture.

VISUALIZING NATURAL HISTORY: MALINALCO AND OTHER AUGUSTINIANS THEBAIDS IN NEW SPAIN

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Abstract

Malinalco, Actopan, Tezontepec are examples of Augustinian convents in New Spain with murals reproducing scenes of the natural world which have been interpreted either as a thebaids or representations of the terrestrial Eden.

These iconographic programs made by *tlaquiloque* (local painters), apparently under the direction of friars, express the tensions between them and the indigenous community for the control of the spirituality. The post-tridentine debate promoted the Christian indoctrination through images and their use, as a translation into a common language understandable by every kind of person (Paleotti, 1582), which illuminates ignorant people (San Román, 1583) and "in silence speaks more than others preaching" (Maldonado, 1609). However this constitutes a too restrictive interpretative framework for the extremely rich and plural processes of communication of knowledge between Iberian and Mesoamerican cultures.

This paper aims at contributing to the discussion about the role played by natural history and medicine in the Christianisation of the indigenous population. We will address some of the still open multiple questions in the historiographical debate. The natural knowledge brought from Europe by the friars was appropriated and reinterpreted by indigenous painters in these hybrid (mestizo or syncretic) productions, which show how an original culture in New Spain was generated by the entanglement of different processes of elaboration, communication and circulation of natural knowledge.

Session 24

SKULLS AND STONES MEET SCOOPS AND SCAMS. THE CONSTRUCTION OF PREHISTORIC KNOWLEDGE IN NEWSPAPERS

Organizers: Miquel Carandell Baruzzi, Clara Florensa, Oliver Hochadel

The prehistoric sciences were born at some stage in the mid nineteenth-century. Stone tools but also fossils of early humans were recognized as such by naturalists. Prehistoric archaeology and what was later called paleoanthropology were from the very beginning public sciences. The discoveries were covered amply by newspapers, the public was eager to learn more about "where they came from". At the same time the press was undergoing a major transformation. Between the middle and the end of the nineteenth century the number of newspapers and its circulation increased vastly. This session wants to ask in how far the simultaneity of these two processes influenced the knowledge production in the prehistoric sciences. Following the "logic of the media" it will analyze discoveries and controversies that had a major impact: scoops and scams. Questions of authenticity (and veracity) were central both to the endeavors of the scholars as well as to the coverage of the newspapers. The best-known case in this context is the Piltdown discovery of 1912 (that turned out to be a fraud in 1953). Yet there are numerous other cases where one may study this "cult of discovery" and the interplay between researchers and the media.

The session will address the following questions: How are knowledge claims in prehistory formulated, defended and attacked in the press? How is scientific credibility (authority) established in the public sphere? In how far do the newspapers serve as an "extended battlefield" for scientific controversies? What role do "amateurs", local actors and journalists play? What role did the media play in the nationalist appropriation of fossils or rock art? Obviously answers to these questions will very much depend on the specific context of a scoop or a scam. Therefore the aim of this session is explicitly comparative in order to get a "bigger picture". It will include case studies on Great Britain, Spain, France, Germany, Argentina and Brazil and cover the entire period in question, i.e. from the late nineteenth century to our present. The thesis of this session is that the formation and practice of the prehistoric sciences, that is to say the production of prehistoric knowledge cannot be understood properly without highlighting the role of the press.

Session title: Skull and stones meet scoops and scams. The construction of prehistoric knowledge* in *newspapers

REINVENTING PREHISTORY: EMILE RIVIERE'S ARCHEOLOGY IN THE MIRROR OF FRENCH JOURNALISM

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Abstract

The French archeologist Emile Rivière (1835-1922) had a prominent role in the most important archeological discoveries and paleontological findings between 1872 and the 1900s, such as l'*Homme de Menton* (Nice, Alpes-Maritimes, France) and the Mouthe cave (Les Eyzies-de-Tayac, Dordogne, France). Both discoveries triggered lively debate among scholars, raising issues surrounding the dating of religious practices, and the primitive men's artistic skills.
Rivière, a Parisian doctor who had moved to the Riviera for health reasons, illustrates the trajectory from amateurism to an established scientific position that was common in this period.

Throughout his career, Rivière published his work in a wide range of specialist journals but he also wrote for more general scientific publications; those articles were then recycled by journalists for publication in local newspapers.
Through analysis of the regional press my aim is to investigate how Rivière's important discoveries were presented to a wider audience. Through which types of journals was information on local discoveries disseminated? When was such information published? How were the national and international scientific debates introduced and framed? How did the relationship between the scientific press and newspapers develop?

Exploring the connections between these different types of publication, my paper examines the publishing strategy that underlay Rivière's activities during his scholarly career as he grappled with the controversial questions surrounding the origins of human civilizations.

Session title: Skulls and stones meet scoops and scams. The construction of prehistoric knowledge in newspapers

ONE HEAD AND MANY HEADLINES. THE ROLE OF THE PRESS IN THE STEINAU AFFAIR OF 1911

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Abstract

In April of 1911, workers discovered a mysterious skull while excavating a cave near the small town of Steinau, in Hessen, Germany for a local association. The leader of the excavation thought it might be prehistoric and alerted some of the leading German anthropologists, sending photos of the skull. The following months saw a flurry of visitors coming to Steinau, inspecting and debating the antiquity of the discovery. Soon it became clear that the skull actually belonged to a chimpanzee and that is was by no means fossilized.

The case was covered in dozens of newspaper articles not only by local media but also by national newspapers. The Steinau case reflects the enormous increase of newspaper coverage around 1900 (in terms of numbers of newspapers but also of readers). This presentation will ask how this increase changed the production of knowledge in the field of human origins. The German anthropologists tried to use the press to advance their own interpretation. Yet at the same time they criticized the sensationalism of the media. The actors in the Steinau affair systematically observed the press, cut out articles, compiled them, cited them in their letters, glued them into their diaries and notebooks and sent them on in order to prove their point or to denounce their opponents. The paper clips of the articles were in a sense the fuel of the debate and the raw material of knowledge in the making.

Session title: Skulls and stones meet scoops and scams. The construction of prehistoric knowledge in newspapers

THE "DISCOVERY" OF THE NATION'S PRIMITIVE SOUL: PREHISTORIC CAVE ART IN SPANISH PRESS (1902-1936)

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Abstract

After 1902, prehistoric cave art emerged as the spearhead of prehistoric research. If the number of decorated caves discovered in Western Europe multiplied as a result of the scientific exploitation of the territory, another push for the discipline came from the increased interest for those matters among larger sectors of society; archaeological discoveries made headlines and front pages in the press and the fascination of the public for the remote past grew at the same time that archaeological imaginary began being used in popular culture.

In 1921, the Exhibition of Spanish Prehistoric Art, was designed by the leading Spanish prehistorians in Madrid to demonstrate the high relevance of those manifestations for national identity, since cave art was conceptualised as the first chapter of Spanish art tradition and its first discoverers were paid tribute. And, in 1929, the display titled "Primitive Spain" was one of the main sights at the International Exhibition of Barcelona, as it was highlighted in the press.

The aim of this paper is to analyse how the Spanish press, both newspapers and illustrated magazines, informed on national discoveries of prehistoric cave art in the period 1900-1936. Furthermore, I seek to reflect on how press influenced the production of knowledge in the prehistoric discipline: how did press contribute to construct and to legitimize "discovery accounts"? How was the nation (re)affirmed, displayed and celebrated? How did the press support the success of the aforementioned exhibitions and to fulfill the expectations of its organizers? Examples of press from the main cities of the country (Madrid, Barcelona, Seville, Bilbao) will be analyzed in order to study the use of cave art discoveries by conflicting national projects within the country. Last but not least, this study on the "public dimension" of prehistory will take into account the growing of a tourism industry directed to both national and international public in this period.

Session title: Skull and stones meet scoops and scams. The construction of prehistoric knowledge* in *newspapers

A MAMMOTH IN THE PARK: PALAEONTOLOGY, PRESS AND POPULAR CULTURE IN BARCELONA (1870-1910)

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Abstract

The development of palaeontology in Catalonia was associated with the process of industrialization that transformed the country since the second half of the nineteenth century. In 1883, the first fossil remain of a mammoth was found. Since then, big bones of extinct mammals were unearthed as a result of the construction of big infrastructures like bridges, roads, aquaducts, etc. around the country. All these fossil remains attracted the attention of the local scientific community, which wanted to follow the trends of 'new (modern) countries', like Great Britain or France. Beyond news of scientific findings, the daily press contributed to generate a paleontological popular culture. Extinct mammals, like the mammoth and other "antediluvian" animals, began to be incorporated in the colloquial language in comparative and humorous expressions of something very big or very ancient. They also featured in fantastic or metaphoric stories. But the popular paleontological culture had another manifestation through the link that was established between fossil bones and fantastic animals of popular legends, like the dragon in Wilfredo's legend (from which derived most of traditional feasts in Catalonia) that saw a progressive demystification noticeable in daily press.

When, in December 1907, a sculpture of a mammoth was built in the *Parc de la Ciutadella* of Barcelona, much of this popular paleontological culture was in the air. The project was done under the direction of the newly created Board of Natural Sciences of Barcelona, in charge of studying and popularizing natural history in the city. The mammoth was made of reinforced cement and carried up more meanings than simply the animal the Board wanted to represent: it was linked to a biblical temporality, a national identity and an idea of modernity. Daily press helped us to reconstruct the cultural significance of a sculpture still emblematic of the park.

Session title: Skulls and stones meet scoops and scams. The construction of prehistoric knowledge in newspapers

THE FIRST AMERICAN SCOOP: THE PEDRA FURADA CONTROVERSY IN THE NEWSPAPERS (1978-1998)

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Abstract

In July 1986, the cover of *Nature* featured the rock paintings of the Pedra Furada rock shelter in the Serra da Capivara National Park in the Piauí region in Brazil. In that issue, the Brazilian-French archaeologist Niède Guidon, head of the excavations at Pedra Furada, co-authored an article that pushed back the arrival of the earliest inhabitants of South America to 32.000 years ago, at least twice as the oldest most accepted presence in North America. Although not unique in the archaeological community, this controversial claim was widely reported by newspapers in Brazil, where it was already known due to an early popularization, and in the United States, where it was equally defended and criticized. Some years later, a conference organized by Guidon and its aftermaths were again reported in the press.

In this paper I want to shed light on the role of newspapers in controversies in prehistory in three different ways. Firstly, I will analyze how Guidon's early outreach effort in Brazil helped to transform the Serra da Capivara into a well-known “archaeological brand” in Brazil. Secondly, I will highlight the role of the much younger Pedra Furada's rock paintings pictures as “legitimators” of the controversial earlier human presence in the shelter. And thirdly, I want to emphasize how newspapers were used by Guidon as another “tool” in her quest for recognition, funding and acceptance of the so-called “Piauí Man”. All this will help to understand how newspapers were a crucial agent in the construction of late 20th century prehistoric knowledge.

Session title: Skulls and stones meet scoops and scams. The construction of prehistoric knowledge in newspapers

"DARWIN WAS WRONG". THE INTERNATIONAL MEDIA COVERAGE OF THE OREOPITHECUS'S SKELETON DISCOVERY IN 1958

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Abstract

In August 1958, Johannes Hürzeler, a Swiss palaeontologist of the Museum of Natural History in Basel (Switzerland), unearthed a complete skeleton of *Oreopithecus bambolii* in the coal mines of Grosseto, an Italian village in La Toscana. ,The discovery made headlines in the media around the globe. Some years before, Hürzeler had already travelled around the world, with a suitcase full of Oreopithecus bones, propagating a controversial theory. All scientists had agreed that, to proof it, more bones of Oreopithecus were needed. And there they were.

What was controversial about Hürzeler's theory? He claimed Oreopithecus to be a 12 million years old hominid. That was challenging the age of the oldest hominids known at the time by 10 millions of years. It raised headlines all around the world but the fuss was not about a national contest for having the first hominid but about the uniqueness of man and its relation to apes once more. Darwin's theory was thought to be threatened and detractors said that Hürzeler was biased by his Catholic belief and his willingness to make man special. Some supporters saw it as a contest between the continental world and the Anglo-Saxon world. What they called the Hürzeler's view versus the "orthodox view".

Spanish palaeontologists embraced wholeheartedly Hürzeler's theory and the Spanish press, under the tutelage of a deeply Catholic dictatorship, quickly forged headlines such as "Darwin was wrong, we do not descend from apes". The theory met with scientific approval not only in Spain, but also abroad. Yet the newspaper coverage in different western countries followed distinctive patterns. In this paper I want to show the differences between these coverages as well as how this case was used to define western science by defining boundaries between science and religion and scientists and lay people. I would also like to highlight the insight this case provides of the processes to maintain national scientific authority.

Session title: Skulls and stones meet scoops and scams. The construction of prehistoric knowledge in newspapers

PEKING MAN IN THE INTERNATIONAL PRESS: HUMAN EVOLUTION, SCIENTIFIC POPULARIZATION AND THE MEDIA, 1925-1939.

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Abstract

The “Peking Man” fossils discovered in Zhoukoudian in the late-1920s and early-1930s have tended to be studied in terms of national and popular science in China in the post-1949 period. However, their earlier significance was very much predicated on international connections and dramatic scientific publicity. Stories filled the international press of how a cave in China was bringing up a sequence of striking evidence of “the oldest man known to Science” – first teeth, then bones, then skulls, then tools and evidence of fire. As these finds were displayed across both the scientific press and popular media, Peking Man became front-page news across the world. The content of the resulting reports in some respects presents an early example of the still familiar excitement generated by hominid fossils, allowing wide reflections on the evolution, origins and nature of humanity. But it was also affected by the conduct of the excavations themselves. These were pursued by an diverse team of scholars funded by the Rockefeller Foundation, and the narrative of their activities was well suited to provide a “heroic” image of science - as dynamic, improving, mysterious and international. Not only this, but the scientists at Zhoukoudian relied on press contacts and media publicity to gain recognition for their often controversial finds, secure continued financial support, and build an international profile. This paper will examine the discussion of Peking Man in the British, American, German and French press and these media strategies, to show some of the dynamics of public engagement with human evolution and the international spread of scientific news in the interwar period – illustrating both the motifs around human origins, and scientific involvement with the press in these formative years.

Session title: Skulls and stones meet scoops and scams. The construction of prehistoric knowledge in newspapers

PAPER PAST. ARCHAEOLOGY IN THE SOUTH AMERICAN PRESS FROM THE 1880S

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Abstract

Late in the nineteenth century, local and international news concerning the progress of geological archaeology abounded in the everyday life press. Science novelties and the progress of media fed each other. In the particular case of South America, this willingness to publish in the press and the exposition to the news to the more general public should not be attributed to the lack of specialized scientific journals. On the contrary, in a context where political and professional spheres were deeply interconnected, where funding depended on political alliances and favours, the press was the public scene where state resources or private support were negotiated.

This paper will analyze two cases that represent two historiographical scales: first, it will present a case connected with the controversies over the antiquity of the Pampean geological formation as appeared in the press from Buenos Aires, early in the 1880s. The second case refers to three itinerant confidence men - an Italian traveling doctor, a French and a Spanish journalist- who traveled in Argentina, Paraguay, Bolivia, Peru, Ecuador, and Colombia, taking on the role of archaeologists and geologists, founding ephemeral periodicals, collecting local antiquities, and promoting the virtues of science in the countries they visited.

This paper will also discuss what kind of historiographical precautions are inherent to the analysis of the news published in the South American press from the late nineteenth century.

Session 25

CULTURES OF PREDICTION: THE CHALLENGE OF COMPUTER SIMULATION IN AND FOR THE HISTORY OF SCIENCE

Organizer: Matthias Heymann

Aarhus University

A scientific revolution has been under way in the last half century; its investigation and understanding is still in its beginnings: computer simulation. Computer simulation transformed knowledge practices like calculation, representation, communication and visualization in fundamental ways. It provided a powerful means for the representation and investigation of complex systems and the production of predictive knowledge; and it caused significant discussion about the limits of models and simulation and the uncertainty of simulation knowledge. Most scholars interested in computer simulation agree that these transformations constitute a deep epistemic and cultural change in the sciences as well as in broader culture.

In this session we suggest to investigate domains in which computer simulation has become predominant as “cultures of prediction” (Gary Fine). The term “cultures of prediction” emphasizes the local origin and social and contingent character of cultural formations built around the construction and use of computer models for predictive purposes. Cultures of prediction operate in specific scientific and social contexts and reveal sets of shared knowledge, practices, values, and rules which emerge, stabilize, and shape scientific and public perceptions, conduct, and goals. While cultures of prediction are based in scientific communities and knowledge, they extend far beyond the realm of science to inform and shape social practice, meaning, and authority in broader society.

The session will focus on one of the most prominent examples: climate simulation. In recent years, climate modeling has emerged as the leading method of climate research. The emergence of climate simulation as a predominant practice in climate research raises many questions: How did climate simulation evolve and gain legitimation? How did scientists develop trust in their models and in simulation approaches? How were simulation approaches negotiated in the broader climatology communities and which controversies unfolded? How did climate simulation impact interests in climate and its very understandings? How did knowledge about climate modelling and simulation disseminate and travel? Which scientific and social interests pushed the application of climate models for predictive purposes?

Session 25: Cultures Of Prediction: the Challenge of Computer Simulation In and For the History of Science

CIRCULATION OF PIECES OF CODE IN CLIMATE MODELS

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Although the dynamic core of general circulation models (GCM) hasn´t changed much over the last decades the subscale parametrizations are rapidly altered and expanded by the modelers. This everyday work of alteration and expansion of algorithms involves the share of concepts, equations, and software codes respectively algorithms. However, the exchange of concepts, equations, and algorithms leads on the one hand to generalization and unification of climate models, on the other hand it requires 'regionalization' due to the specific model and the purpose of the aims. Following a piece of code from its initial programming to its distribution through various model generations and different models of an international cooperation, the chapter analyses the patterns of incorporations and adaptations in case of a specific GCM cloud parametrization. The paper is based on a code analysis of cloud parametrization of the Max-Planck Institute of Meteorology Hamburg, the ETH Zurich and the Oslo University.

Session 25: Cultures Of Prediction: the Challenge of Computer Simulation In and For the History of Science

THE IMPROVEMENT OF CLOUD PARAMETERIZATION IN CLIMATE MODELS: PRACTICES AND STRATEGIES IN DEBATE

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Climate models have emerged as the main instruments of knowledge production in climate sciences and the only tools for the production or predictive knowledge about climate change. These models are very complex entities which involve great simpli-fications on many levels. How did scientists decide on improvements of climate mo-dels? This paper will present results from a case study of a parametrization develop-ment for climate modelling in the French Laboratoire de Météorologie Dynamique (Paris), which was pursued based on a network of historians of science and climate scientists. The investigation shows that model development and improvement genera-ted lively debates in the scientific community and raise central issues in epistemology as well as in politics of science. I will show that modeller's discourses, strategies and practices involve various ideas of models, their roles, their functions, their limits and what they allow (and don't allow) to predict and to understand. Furthermore, different institutions, practices and model states gave rise to different visions and epistemo-logies of climate models.

Session 25: Cultures Of Prediction: the Challenge of Computer Simulation In and For the History of Science

NEGOTIATION LIMITS: FROM HEURISTIC TO PREDICTIVE CLIMATE MODELLING, 1970-1985

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Climate simulation emerged as a new scientific practice in a very small community of meteorologists and atmospheric scientists in the 1960s. After only few decades it had become a predominant research strategy in climate research and served as a predictive tool for institutions such as the IPCC. In this paper I wish to focus on one key episode in the emergence of climate modeling as a hegemonic research strategy: the shift from heuristic climate modeling as a means to improve scientific understanding of the atmosphere to the application of models for future climate prediction, which emerged in the 1970s in the USA. The paper will focus on the contribution of a new generation of leading US climate modelers Stephen H. Schneider, William W. Kellogg, James E. Hansen and on the controversy about the application of climate models caused by criticism of Edward Lorenz. It draws from results of an ongoing research project, which examines the emergence of climate modeling as a *culture of prediction* in the formative period between ca. 1960 and 1985 and aims at investigating questions like the following: Which scientific and social interests pushed the application of models for predictive purposes? How were uncertainties and limits of climate modeling negotiated? How and why did predictive modeling gain acceptance?

Session 25: Cultures Of Prediction: the Challenge of Computer Simulation In and For the History of Science

CLIMATE, COMPUTERS AND CONTROVERSY: BOUNDARY WORK AT THE UK METEOROLOGICAL OFFICE

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This paper aims to tackle the themes of the session by looking at a case study: that of the United Kingdom in the late 1960s and early 1970s.

In 1971-1972, after 36 years of national service and with a reputation as one of Britain's leading experts on climate, Hubert H. Lamb quit the Meteorological Office and founded the Climatic Research Unit (CRU) at the University of East Anglia. This was the final act in a long-standing conflict with the Director of the Meteorological Office, B.J. Mason: a conflict centered on a philosophical split over climate research, and a conflict which saw Lamb's historically-based research program eroded in favour of Mason's preference for numerical modeling. By leaving the Meterological Office and setting up the Climatic Research Unit, Lamb staked his reputation and success on a particular vision of climatology – one which disagreed with the increasing hegemony of computer modeling in the climatological sphere.

This paper aims to unpack this story by examining four main questions: how did epistemic authority change at the Meteorological Office in the late 1960s and early 1970s, as numerical modeling began to emerge in climate research? Why were certain types of knowledge valued, and others not? Within this context, how did climate scientists construct scientific and political identities to respond to the changing currents of the times? How did 'external' factors (namely, political pressures, societal and cultural norms, and international competitiveness) affect climate research cultures in the UK at this time?

Session 26

LOCAL SUPPLY OF SCIENTIFIC AND TECHNICAL EDUCATION

Organizers: Renaud d'Enfert[a], Virginie Fonteneau[b]

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This symposium aims to approach the history of the circulation and transmission of scientific and technical knowledge by studying the teachings and trainings given within the various scientific and technical educational institutions on a particular territory (the city, the region, etc.), that is to say the "local supply of scientific and technical education". There will be a particular emphasis on using disciplinary approach (mathematics, chemistry, accounting, etc.) and considering teachers as forming common pool. From this point of view, circulations between institutions as well as their potential complementarity and/or rivalry will be examined together with emergences of a "local system of teaching". Another topic will consist in identifying local practices regarding particular constraints and freedoms of a given territory. Inter-national local studies should also provide a better understanding of the relationships between local institutions and norms set by local tradition or practice or by national regulations when they exist.

Session title: Local supply of scientific and technical education

MATHEMATICS AND IDEOLOGY IN TURIN DURING THE FASCIST DICTATORSHIP (1922-1945)

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Abstract

In this talk we analyse the teaching of mathematics in Turin during the period of the fascist dictatorship and the dynamics of its ideologization. Particular attention will be devoted to the exam of the mathematical, methodological and social aspects of scientific education in three orders of scholastic system: the elementary schools, the *licei* and the *istituti magistrali*, that are the schools charged with the training of elementary teachers.

Analysing the publications of this period and thanks to sources preserved in some local archives (the Peano archives in Cuneo and Turin, the archive of the Piedmont's section of the National Fascist Party, the Library of *Liceo D'Azeglio* and that of the Israelite school *Colonna-Finzi*, etc.) we will described the cultural and political activities of some Turin University teachers and middle-secondary educators (Giuseppe Peano, Giovanni Vidari, Cesare Burali-Forti, Rodolfo Bettazzi, Maria Mascalchi, Ida Terracini, Emilio Artom,…) in the years of dictatorship and after racial persecutions. We will illustrate also the circulation - in a local and semi-peripherical context, such as the Turinese one - of information and didactic materials coming from abroad, in spite of the Ministerial directives on the so-called cultural autarchy.

Session title: Local supply of scientific and technical education

SCHOOL TEACHING IN THE BERGSTAAT: MATHEMATICS IN THE ORE MOUNTAINS OF SAXONY (1750-1850)

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Abstract

Mining areas in Germany have a number of specificities and traditions that dates back to the Middle Ages and have led historians to study them as independent entities called ?mining states? (Bergstaaten). Cities in the Ore Mountains (in the South of Saxony) have a long tradition of technical instruction for the training of mining officials and engineers that possess very specialized knowledge. Practical mathematics are one of the most important topic, being used from subterranean geometry to machine construction. During the 17th and 18th centuries, this training is ensured by a companionship system that is gradually institutionalized and supervized by the local mining authorities. The creation of a general mining academy in 1765 is followed by the establishment of a web of primary and secondary teaching institutions. The content of the mathematical curriculum is primarily determined by the local needs and orientated towards the acquisition of practical skills. In the first half of the 19th century, the general government of Saxony tries to establish a unified and coherent curriculum for primary and secondary schools. The importance of classical philology for the reformers leads to very different assumptions in regard to the scope, goals and methods of the mathematical curriculum. The aim of this talk is first to describe the specificity of mathematics teaching in the Bergstaat in the 18th century. We will subsequently analyze the adaptation of this local teaching system to a more general educational frame during the following decades.

Session title: Local supply of scientific and technical education

TEACHING EXPERIMENTAL PHYSICS AND MECHANICS IN BARCELONA PRIOR 1842

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Abstract

During the first half of the 19th century an industrial development process took place in Spain especially in Catalonia. At the beginning of the century, Catalonia held a favorable attitude towards mechanical arts and the work of the artisans who were socially recognized. It soon excelled in the industrialization process especially in the textile sector. The need for a formal technical training focused on industrial interests moved the Board of Commerce (*Junta de Comercio*) of Barcelona to promote the creation of free technical schools. They focused on technical education for the needs of the new industrial society.

The new schools: *Chemistry applied to the Arts* (1805), *Mechanical* (1808) or *Experimental Physics* (1814) initially had a strong French influence but their contents were adapted to local needs. In a few decades, Mechanical and Experimental Physics schools developed: one to the teaching of machinery (1833) and the other towards experimental physics applied to the arts (1840). The process of transforming these teachings increasingly targeting industrial applications presented difficulties. It took place in a context of great political and social changes in Spain: the transition from the old regime to the liberal system. This historical context contributed to the reestablishment of the University of Barcelona (1837-1842).

Session title: Local supply of scientific and technical education

ACCOUNTING, LOCAL TRAINING SYSTEM, GENDER. THE LYONNESE CASE, 1850-1910

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Abstract

This paper examines the dissemination of accounting knowledge ans techniques between different institutions of technical and vocational education at the level of a major industrial and commercial city, Lyon, from mid-19th century to the first decade of the 20th Century. Educational institutions founded within the urban area the conditions of their development : increasing business demand for chief accountants and clerks - men and more and more women-, an educated population able to extend his/her studies to obtain these qualifications. So in the 1850-1860 decades, "commercial" training, run or fund by city concil, Chamber of commerce, employers or individuals, developed across the city, building over decades relations of competition and complementarity. Accounting knowledge which was then taught is still poorly analysed by historians, mainly because of the absence of national regulations which only appeared at the turn of the century. Then, it's assumed that local interactions also built this technical knowledge.

As a result, we will focus on the ways this knowledge circulated and was transmitted between different urban institutions. At the heart of these circulations, teachers were one of the actors who played a major part, transmitting accounting knowledge from one institution to another. Thus, we will pay particular attention to the circulation of teachers/knowledge between male and female accounting courses : how local approach of training systems can enrich our analysis of the construction of a gendered technical knowledge ? Do local practices in terms of organization of teaching from one institution to another participate in the construction of gender norms that will shape gradually accounting techniques ?

Session 27

SCIENTIFIC PRACTICE IN AMATEUR RESEARCH, C. 1850–1914: A STUDY ACROSS DISCIPLINES

Organizer: Benjamin Mirwald

Parallel to full-time professional research in science, there has always been amateur activity as well. Because “amateur science” is hard to define, historic research has to consider the fields amateurs were committed to, what kinds of knowledge they generated, how and with whom they performed their work.

As the call for papers points out, “the vertical model of diffusion [from academic to lay audiences] has been superseded by a horizontal conception of circulation and appropriation of science” in such a way that this conception is “blurring the distinction between the making and the communicating of science.” Amateur science is among the contradictory evidence to the vertical model. We therefore focus on scientific research carried out by amateurs who had not been employed in academia during their lifetime.

This symposium covers not only the questions how amateurs took part in generating new knowledge, but also how they broadened, adapted or transformed scientific concepts: So how were they engaged in the forming of new, or did they form their own scientific disciplines? More specifically, we pose a whole set of questions: Can one identify specific traits of amateur research? How does its content relate to contemporary research in academia? Did amateurs mostly act in a self-determined manner or were they exploited as “resources” by professional actors? How were their agendas formed, how was their research funded? What networks of contacts did amateurs use? Since when have there been specialized journals and organizations for and by amateurs? How well developed was their cooperation on a national, European or international level? Which roles did amateurs have in education and what was their own educational background?

We will present one talk each on amateurs in biology (Mike Buttolph), physics (Johannes-Geert Hagmann) and on amateur astronomy (Benjamin Mirwald). The restriction to the period from around 1850 to 1914 shall benefit to a comparative discussion among different disciplines.

Session Title: Scientific Practice In Amateur Research, C. 1850–1914 — A Study Across Disciplines

AMATEUR CONTRIBUTIONS TO THE DEVELOPMENT OF MENDELISM, 1900 - 1914

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Abstract

Mendel's work of the 1860s came to be understood and widely known in 1900. He had studied several species, but from his data from hybridisations of peas he showed simple, predictable patterns of inheritance. The 'rediscovery' of Mendel's ideas raised new questions, particularly about the extent to which mendelian patterns of heredity were to be found in other plants, and animals including humans. From 1900, there was a large-scale, uncoordinated programme of research to test, modify and extend the new mendelism. New experimental programmes were established to address these issues, but important results were also obtained by the reanalysis of nineteenth-century data sets, many of which had been created by amateurs. A few of these amateurs set out to advance the new science of mendelian genetics and formed long-term relationships with the professional genetics community. However, most of the amateurs had the more limited goal of challenging the capacity of the new mendelism to explain their prior observations from a species or genus of which they had detailed knowledge.

Many of the amateurs involved were of independent means, but others were employed in the army, industry, music teaching, theology and commercial photography. These amateurs constituted a loosely-bound and disparate subset of the biological community. They made claims, entered into disputes, formed and dissolved alliances in much the same way as other groups within British society in the decade before 1914.

Session Title: Scientific Practice In Amateur Research, C. 1850–1914 — A Study Across Disciplines

AMATEURS IN AN AGE OF PROFESSIONALS: EXPERIMENTAL CONTRIBUTIONS TO PHYSICS SUB-DISCIPLINES FROM OUTSIDERS 1850-1914

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Abstract

In the second half of the 19th century, a number of sub-disciplines emerged in experimental physics through professional scientific activity. The differentiation process took place first and foremost in universities, with the development of new areas of research, their subsequent integration in teaching, the formation of associations and new outlets for the communication of research results. This process of specialization also led to increasing technical and financial requirements to carry out research activities, such that significant scientific contributions from individuals without any academic affiliation and training in the relevant discipline became increasingly rare.

This paper analyzes the boundary conditions under which amateur contributions to physics sub-disciplines such as spectroscopy or physical meteorology could successfully be made, and the reactions that they received from the academic community. Given the small number of amateur scientist working in experimental physics in this period, the study relies on a comparison of case studies of individuals. It is argued that while professionalization increasingly added to the difficulty of their activity, the concomitant dynamics of discipline formation also provided new entries for their scientific contributions.

Session Title: Scientific Practice In Amateur Research, C. 1850–1914 — A Study Across Disciplines

AMATEURS' DISCIPLINE – NON-PROFESSIONAL ASTRONOMER'S INTERESTS AND NETWORKS, 1850 – 1914

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Abstract

Amateur astronomy was more and more organized like an academic discipline in the second half of the 19th century. Amateurs may have carried out their observations in a lonesome setting, but otherwise they were closely connected. While they still tried to take part in academic discourse, amateur astronomy developed its own forms of cooperation and communication.

In the case of german-speaking countries, severel amateurs played the role of networking nodes: Philipp Fauth collected drawings of planets, Joseph Plassmann instructed others in observations of variable stars, Spiridion Gopčević (aka Leo Brenner) edited a homebrewn popular journal, Eduard von Lade worked on selenography, and Samuel Heinrich Schwabe discovered the periodicity of the number of sunspots. Such amateurs, often working as secondary school teachers, coordinated what work should be done in observing campaigns related to phenomena like variable stars, meteors or the surface of the sun.

Around the 1860ies, special journals centered on amateur astronomers emerged. In nearly all European countries new organisations for amateur and popular astronomy were founded: In Germany the association of friends of astronomy and cosmic physics (Vereinigung von Freunden der Astronomie und kosmischen Physik) even started its own research project on noctilucent clouds.

Although this activity resembles the forming of academic disciplines quite well, one difference remains: Amateurs did not distinguish themselves by a special "language" – as one can assess for academic disciplines – from lay audiences. Amateurs also did not specialize as much as academic astronomers in particulars, but eventually became well-known experts in certain fields. I would therefore like to discuss, based on astronomy, whether amateur science follows a similar process of discipline formation as academic science. Or can one better understand the specialization as one effect of interrelation between academic and amateur communities?

MATHEMATICAL CORRESPONDENCES AND CRITICAL EDITIONS

Maria Teresa Borgato[1], Erwin Neuenschwander[2], Irène Passeron[3]

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Letter writing has always been very important for the spreading of scientific ideas, even in periods with a great number of specialized journals.

The correspondences on mathematical issues or those of interest in the history of mathematics involve a vast field of topics, not only of a scientific nature. They include letters between mathematicians and from mathematicians to politicians, publishers, and men or women of culture. Leibniz, Euler, D'Alembert, Lambert, Lagrange, Laplace, Gauss, Hermite and Cremona are undoubtedly authors of great interest and their letters are precious documents, but the correspondence of less well-known authors can also give an important contribution to the history of science.

All these kinds of correspondences constitute an essential component in the reconstruction of the genesis of scientific ideas, relations and debates, biographies and, finally, in the correct dating of various memoirs: their publication is, therefore, important for the success of critical editions of the works of great mathematicians (Galileo, Newton, Huygens, Euler, the Bernoulli, etc.).

In our symposium we will mainly focus on correspondences of the XVI-XX centuries, related to all mathematical sciences.

We are also interested in investigating the digital editions of correspondences, which make mathematical works available to a wider public and facilitate the search for information within the texts.

We invite scholars to reflect on these topics within the frame of the 6th International Conference of the European Society of History of Science (Lisbon, 4-6 September 2014): "Communicating Science and Technology".

Session 28: Mathematical Correspondences and Critical Editions (i)

SCIENTIFIC DEBATE AND EDITORIAL PRACTICE THE CORRESPONDENCE OF JOHN WALLIS (1616-1703)

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Learned correspondence played an important role in the communication and dissemination of mathematical ideas in early modern Europe. Debates such as that over the method of tangents in the early 1670s took place almost exclusively through the epistolary medium or through the related medium of the scholarly article published in journals such as the Philosophical Transactions or the Journal des Sçavans. Taking the example of the Savilian professor of geometry at Oxford, John Wallis, the talk will outline how critical editions of the correspondence of seventeenth-century mathematicians can contribute to a deeper understanding of the form and content of such debates while at the same time considering how editions might best respond to their multi-authored nature.

Session 28: Mathematical Correspondences and Critical Editions (i)

THE „BASLER EDITION DER BERNOULLI-BRIEFWECHSEL“

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The aim of the online “Basler Edition der Bernoulli-Briefwechsel” is to make available all unpublished letter exchanges of the Basel mathematicians Daniel Bernoulli (1700-1782), Jacob II Bernoulli (1759-1789), Johann I Bernoulli (1667-1748), Johann II Bernoulli (1710-1790), Nicolaus I Bernoulli (1687-1759), Nicolaus II Bernoulli (1695-1726) and Jacob Hermann (1678-1733). Some of the correspondents were outstanding scientists of the early 18th century like Leibniz, Newton, Wolff, Bilfinger, De Mairan, Maupertuis, Varignon, Clairaut, Montmort, de Moivre, Michelotti, Riccati and Scheuchzer. The texts are presented through open access in the internet (www.ub.unibas.ch/bernoulli) and are thereby accessible for the first time to a wide scientific community.

The first part of this presentation will give an insight into the different steps of our editorial work. These include the digitalisation of the transcriptions, the constitution of a reliable, critically established text through comparison of the digitalised transcriptions with the respective manuscripts of the letters and the documentation of remarks regarding textual criticism in the footnote apparatus. Following this, the components of the edition will be presented (i.e. the metadata, the transcriptions, high resolution images and scientific comments on the letters). Finally, different search tools which allow us to conduct specific searches within the transcriptions and metadata will be introduced.

The second part will illustrate our work by means of the ongoing subproject, i.e. the interdisciplinary commented edition of almost 750 letters exchanged between some of the Bernoulli, Jacob Hermann, Johann Jakob Scheuchzer (1672-1733) and his brother Johannes Scheuchzer (1684-1738). In order to achieve a scientifically consistent and comprehensive analysis of the various research areas and other topics the correspondents touched upon in their letters, the comments are compiled in collaboration with external experts from different fields such as mathematics, physics, astronomy, natural history, geology, meteorology, cartography, theology, Swiss political history, censorship and the Enlightenment.

Session 28: Mathematical Correspondences and Critical Editions (i)

NEWTON 2.0: CREATING AND CURATING AN ONLINE EDITION OF NEWTON'S MATHEMATICAL WRITINGS

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The Newton Project has transcribed and published most of Newton's mathematical writings (all in full for the first time), and by the summer of 2014 will have published all of his mathematical correspondence. This provides a unique opportunity to explore the full potential of the Web to create a state of the art edition of Newton's papers. The edition will provide full text transcripts in TEI-P5 compatible MathML, with the capacity to simultaneously access high quality images of the originals. The edition is of course embedded in the wider collection of Newton's writings in religion and science, and in due course there will be extended commentaries and notes on the mathematical materials. Apart from offering links to Newton's printed sources, and beyond providing access to later re-uses by others of his own published and unpublished materials, the edition will also translate Newton's own notation into a modern form. This (of course) will preserve the original notational form, while expanding access to his work for those who lack Latin or a historical grounding in late seventeenth century mathematics. We also hope to use novel software such as Latent Semantic Analysis in order to interrogate the relations between the texts in question, and we will harness the power of crowdsourcing in order to aid the editorial and interpretive process. As a result, we hope to give a comprehensive account of how Newton made use of his own private materials in releasing his work in correspondence and printed form.

Session 28: Mathematical Correspondences and Critical Editions (i)

THE MATHEMATICAL CORRESPONDENCE OF D'ALEMBERT: CAN WE SPEAK OF A NETWORK?

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D'Alembert (1717-1783) corresponded with some of the greatest mathematicians of his time, Leonhard Euler, Gabriel Cramer, and Joseph Louis Lagrange, and his correspondence sheds light on the scientific controversies and debates of the day, as well as the organization of the scholarly milieu in the middle of the eighteenth century. We will look more closely at how mathematical questions interact with the other contents of the letters and other forms of communication: published books, periodicals, and the *Encyclopédie*.

Session 28: Mathematical Correspondences and Critical Editions (ii)

THE DIGITAL EDITION OF D'ALEMBERT'S CORRESPONDENCE: PROBLEMS, ACHIEVEMENTS AND PERSPECTIVES

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In conjunction with the preparation of a critical edition in printed form, the group of the Complete Works of D'Alembert has been working for several years now to produce a digital edition of the correspondence of the famous French scholar and encyclopaedist based on the following principles: various means of consultation and search tools in the corpus, development of the many surviving manuscripts, renewal of the circulation within the corpus, the rich critical apparatus being formed and many other works by the author, and provision of useful and relevant research tools for the more specialized reader. This presentation will provide an opportunity to illustrate the concrete results of the work, and state the difficulties encountered as well as the long term development prospects envisaged.

Session 28: Mathematical Correspondences and Critical Editions (ii)

EULER'S FIRST LETTER TO D'ALEMBERT REDISCOVERED

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Leonhard Euler's extant correspondence contains approximately 3100 letters exchanged with nearly 300 correspondents. For historians of mathematics, the correspondence with Jean le Rond d'Alembert, Daniel Bernoulli, Christian Goldbach and Johann Andreas von Segner is of special interest. In 1967, the Swiss Euler Committee decided to complement the three series (mathematics; mechanics and astronomy; physics and miscellaneous) of the Opera omnia Leonardi Euleri, initiated in 1907, with an additional series containing his letters as well as his manuscripts. The first four volumes of the series IVA of Euler's correspondence have meanwhile been edited; five additional volumes are expected to be published in the next few years.

While researching the network of one of Euler's correspondents, Johann Caspar Wetstein, the present author discovered Euler's first letter to d'Alembert. Part of this letter is a guarded answer to d'Alembert's former request of support in his views against some of the ideas Daniel Bernoulli had published in his Hydrodynamica of 1738. The main part of the letter, however, contains the essentials of the theory of the vibrating string that Euler was to publish a few years later. This letter will be presented for the first time at the 6th International Conference of the European Society for the History of Science in Lisbon.

Session 28: Mathematical Correspondences and Critical Editions (ii)

LAGRANGE'S COLLECTED WORKS AND CORRESPONDENCE

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Under the auspices of the French State, several editions have been produced of the complete works of great mathematicians from the past, starting from the XIX century; these include J. L. Lagrange (1736-1813), P. S. Laplace, and A. L. Cauchy. Only the *Œuvres de Lagrange* (14 vols, 1867-1892) contained his correspondence. What remains of Laplace's correspondence, including his letters to Lagrange, has recently been published (ed. by R. Hahn), but that of Cauchy has not yet been collected. The correspondence between Lagrange and Euler was published again in the last century in the edition of Euler's works, and included an important unedited letter on the minimal surface differential equation. In the last century about a hundred other letters of Lagrange were published separately, some of which are of scientific interest (with D. Bernoulli) whereas many others concern private matters. A few others are still unedited. The aim is to take stock of the sum of Lagrange's correspondence, in relation to both the edition of the *Œuvres*, the defects of which are evident, and the biography of this illustrious mathematician from Turin, who lived in Berlin under Frederick II and in Paris during the Revolution and the reign of Napoleon.

Session 28: Mathematical Correspondences and Critical Editions (ii)

THE ANALYTICAL AND MATERIAL INVENTORY OF THE CORRESPONDENCE OF CONDORCET: ISSUES AND METHODS

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Until now, the studies on Condorcet could only weakly rely on his correspondence. A true bibliographic gap persists, while comprehensive inventories, general editions of correspondences or complete works have been published or are nearing completion for many of his contemporaries – namely, to mention only a few scientists, d'Alembert, Joseph Banks, the Bernoullis, Leonhard Euler, Laplace, Lavoisier or even Haller... The inventory currently in preparation intends to fully disclose the extent and variety of Condorcet's relations with philosophers, politicians, administrators but also scholars of his time. For a long period, in fact, the scientific figure of Condorcet was obscured in favour of the image of man of the Enlightenment, defender of the Enlightenment ideals of 1789 and victim of the Terror. Uncovering his scientific correspondence, still largely unpublished, will contribute to the rehabilitation of his status as a scientist, for most of his intellectual career at the head of the most important scientific institution of his time, the Royal Academy of Sciences of Paris. But the problems of investigating the whole correspondence of Condorcet, of identifying his correspondents and dating the letters are, in this case, very difficult. We present the methods used to overcome these problems, which include, in particular, a detailed material analysis of the letters.

Session 28: Mathematical Correspondences and Critical Editions (iii)

GASPARD MONGE'S UNPUBLISHED MATHEMATICAL CORRESPONDENCE TO HIS PUPIL DUBREUIL DU MARCHAIS FROM 1768 TO 1772

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From 1768 to 1772, Gaspard Monge (1746-1818) wrote seven letters to his pupil Dubreuil du Marchais, probably his first scientific correspondent. In 1767, when he first met Dubreuil, Monge was Bossut's assistant at the Royal school of military engineering of Mézières. Dubreuil left the school and began his military career in 1769 and Monge continued to write long letters describing his mathematical research and focusing on his efforts, his difficulties and his achievements. In the same period, he wrote to d'Alembert and to Condorcet. In 1771 and 1772, he presented six Memoirs to the members of the Academy and, in 1772, he became professor of physics at Mézières and Bossut's corresponding member at the Academy of sciences. Taton underlined the fruitfulness of those years and those letters, but he chose to publish the letters of this period addressed to d'Alembert and Condorcet. The letters to his pupil seem to be the drafts of the letters to the academicians.

From 1764, Monge's mathematical training and research were developed within a pedagogical approach combining teachings of mathematics and physics. From January 1769, Monge had undertaken a research on curved surfaces, the first results of which determined the basic lines of his mathematical work. In these few letters to Dubreuil, the essential features of Monge's work already appear, especially the simultaneous use of geometric and analytic methods and the establishment of strong links not only between mathematical domains but also between mathematics and other scientific and technical domains. The study of this correspondence allows us to examine the dynamic relations between the process of elaboration and that of the transmission of knowledge, emphasising the heuristic value and the scientific issue of the pedagogical posture, an essential feature of the scientific practice of the French mathematicians in the late 18th century. Preserved at the École polytechnique library (Palaiseau-France), they remain unpublished.

Session 28: Mathematical Correspondences and Critical Editions (iii)

THE CORRESPONDENCE BETWEEN SOPHIE GERMAIN AND GAUSS

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In the seventies of the nineteenth century, the correspondence between Sophie Germain and Gauss was discovered. Added to some of Sophy Germain's letters are extensive mathematical notes which constitute an essential component in the reconstruction of the scientific biography of the French mathematician. Prince Baldassarre Boncompagni, acting on the mathematical advice of Angelo Genocchi, started its edition, but his project came to nothing. In few years the correspondence was forgotten and Sophy's mathematical notes were believed to be lost forever.

Recently, for the first time, the correspondence between Germain and Gauss, together with the mathematical notes, has been published and annotated in its entirety by A. Del Centina and A. Fiocca.

Letters and notes show that Sophie Germain had made in-depth studies of Gauss' Disquisitiones Aritmeticae and that her contributions to number theory are greater than is usually attributed to her in the literature as far as the first case of Fermat's last theorem is concerned. In a very short time, and also ahead of other more famous mathematicians, she was able to add interesting achievements and to develop ideas and conjectures, such as those regarding n-ary quadratic forms and cubic and biquadratic residues.

The correspondence and the mathematical notes confirm a recent thesis formulated by Del Centina, Laubenbacher and Pengelley independently of each other, that Sophie Germain made important progress in number theory, never attributed to her before.

Session 28: Mathematical Correspondences and Critical Editions (iii)

ON GIUSTO BELLAVITIS'S CORRESPONDENCE

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Giusto Bellavitis (1803-1888) was an Italian mathematician from Venice who, from1832, proposed an equipollence calculus in order to study the "nature" of complex numbers, i.e. their geometrical foundation. In this context, Bellavitis analysed other interesting mathematical topics. Bellavitis's cultural route was peculiar (although he was a self-taught man, he became full professor at Padua University and Senator of the Italian Kingdom) and he exchanged letters with Italian and foreign mathematicians. Among the Italians we find Conti, Fusinieri, Barbieri, Turazza, Mainardi, Genocchi, Chelini, Minich, Piola and others; among foreign mathematicians, Moebius, Zahradnik, Laisant, and Houel. His correspondence provides a cross-section of Italian mathematical culture before Cremona (first part of XIX century). Despite some provincial aspects, this culture is, however, historically interesting and representative of Italian mathematics in that period. In fact, the equipollence calculus arises from the established concepts in Lazare Carnot's Géométrie de Position and represents the first kind of geometrical plane calculus (linked to the geometrical interpretation of complex numbers). After 1844, we find the grand constructions of geometrical calculus by W.R. Hamilton (quaternions) and H.G. Grassmann (Ausdehnungslehre).

Session Title: Mathematical Correspondences and Critical Editions

THE ROLE OF CORRESPONDENCE IN MATHEMATISING FIELD THEORY

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Abstract

This paper will examine the role of Faraday's correspondence with Julius Plücker, William Thomson (later Lord Kelvin) and James Clerk Maxwell in turning Michael Faraday's qualitative theory of the electro-magnetic field into a powerful mathematical theory. The formulation by Michael Faraday of field theory was his way of interpreting his experimental discoveries of the magneto-optical effect and diamagnetism made in 1845. In part Faraday clarified his ideas in response to the experimental and theoretical work of Plücker at the University of Bonn and most of their interaction was conducted by correspondence, both sides of which have survived. The theory that Faraday constructed was very qualitative and it was not obvious that it would displace mathematical action at a distance theories of either electrical or magnetic action, as the Astronomer Royal George Airy made clear. However, in the mid-1850s it was found that field theory could solve a number of problems (notably long-distance telegraph signalling) that other theories could not do. This was accomplished by Thomson at the University of Glasgow and his success drew attention to what Maxwell referred to as Faraday's geometrical approach to understanding the world. In correspondence with both Thomson and Maxwell, Faraday helped them mathematise his theory so that it became and remains one of the cornerstones of modern physics.

Session 28: Mathematical Correspondences and Critical Editions (iv)

THE RENEWAL OF MATHEMATICAL RESEARCH IN ITALY: THE CORRESPONDENCES BRIOSCHI-BETTI AND BRIOSCHI-TARDY

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The period of the Unification in Italy saw great renewal in both mathematical research and higher education. Francesco Brioschi's correspondence with Enrico Betti and Placido Tardy, shortly to be published, allow us to reconstruct the scientific debate mainly concerning the theory of invariants of binary forms and the resolution of the equation of the fifth degree by elliptic functions. The correspondence, which consists of 128 letters between 1853 and 1893, also describes the renewal of scientific communication with the birth of the first Italian journal entirely devoted to mathematical research: the *Annali di matematica Pura ed Applicata*. Brioschi and Betti's research, closely related to each other during the 1850s, was linked to the works of Cayley, Sylvester and Hermite, whereas, after the Unification, they took different directions when Betti, under the influence of Riemann, was more inclined towards mathematical physics, the theory of elasticity and potential in particular.

Political issues were taken up in the letters written during the Second War of Independence and the successive proclamation of the Kingdom of Italy, as well as discussions concerning the reform of state education, university policy, the academies and scientific publications. Brioschi and Betti were both involved in all of these fields as deputies of the new Italian parliament and members of the Upper Council of State Education; Brioschi was Director of the Milan Polytechnic from its foundation in 1863 and, from 1865, Betti became Director of the Scuola Normale in Pisa. Tardy, a professor of infinitesimal calculus and then Rector of the University of Genoa, had an important role as interlocutor in this first phase of formation of the Italian school of mathematics. Brioschi's mathematical works (*Opere matematiche di Francesco Brioschi*, 5 vols, 1901-1909) like Betti's (*Opere matematiche di Enrico Betti*, 2 vols, 1903-1913) have been published, without the correspondence, however.

Session 28: Mathematical Correspondences and Critical Editions (iv)

THE CORRESPONDENCES OF LUIGI CREMONA AND PLACIDO TARDY OF THE LIBRARIES OF GENOA

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The aim of this communication is to describe the historical framework and the main issues (biographical, scientific, political etc.) through an analysis of the correspondences of Placido Tardy and Luigi Cremona of the libraries of Genoa, which constitute an important contribution to the reconstruction of the History of Mathematics of the Italian "Risorgimento". In particular, we will deal with the correspondences Tardy-Cremona, Tardy-Betti and Guccia-Cremona, already published or forthcoming. Tardy's letters are preserved at Genoa University Library, while Cremona's letters at the Mazziniano Institute of Genoa.

Placido Tardy (1816-1914) left Sicily in 1848 for political reasons. From 1851 he was professor of analytic geometry and calculus at the Navy School of Genoa and from 1859 he was professor of calculus at the University of Genoa. Even though he was not a mathematician of the first magnitude, he had a key role in the first stage of the development of Italian Mathematics at the turn of 1860, as evidenced by the correspondence he held with leading mathematicians of the time.

Luigi Cremona (1816-1903) was one of the main mathematicians of the Risorgimento. He graduated in engineering in 1853 at Pavia and in 1860 he became professor of higher geometry at the University of Bologna. In 1867 he went to teach at the Polytechnic of Milan. In 1873 he was called to Rome by the Minister of Education, Scialoja, to head the School for Engineers where he taught Statics graphics until 1877 when he was given the Chair of Higher Mathematics at the University. In 1879 he was named Senator of the Kingdom. The correspondence preserved in Genoa completes the biographical, scientific and political information on Cremona.

Session 28: Mathematical Correspondences and Critical Editions (iv)

DEMOCRATIZATION OF MATHEMATICS THROUGH CREMONA'S CORRESPONDENCE WITH FOREIGN COLLEAGUES (1861-1901)

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Between the 19th and 20th centuries many common traits were shared by national mathematical communities geographically far apart (from the Czech lands to Japan), culturally (from north to south Europe) or as to the dynamism of original research (from Germany to the United States). Societies and journals in the national language were launched, thanks to the widening of the social platform of mathematics and the emergence of a national leadership; the deployment of the state school systems increased mathematical information; and mathematics played a role and received encouragement from the processes of social and economic modernization and development of state institutions. Intellectual competition among nations, much in the spirit of the 19th century, seems to prevail on the early Modern European universalism. A panorama of almost planetary diffusion of Western mathematics resulted from this evolution, and eventually a reinforcement of international circulation of knowledge, which survived two world wars.

The collection of letters written to Luigi Cremona conserved at the Sapienza University of Rome throws light on several aspects of this evolution. The letters offer a point of view on the "backstage", in contrast with official proclamations; they show the interplay between national leaders and the circles in the capitals and mathematicians working in isolation; they show a variety of connected activities – research, institutional commitments, and cultural fostering, including translations and textbooks. International dialogue grew out of this nebula of initiatives driven by national passion, by philosophical and political convictions, in contrast with the present European trend to entrust the circulations of ideas – and the production of knowledge – to initiatives governed from the top, and standardized (design, funding and assessment), far beyond what would be needed. The edition (in the Académie Internationale d'Histoire des Sciences series "De diversis artibus"), has been carried out by a European team directed by Giorgio Israel.

Session 28: Mathematical Correspondences and Critical Editions (iv)

HERMITE AND LIPSCHITZ: A CORRESPONDENCE AND ITS ECHOES

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Charles Hermite wrote thousands of letters to dozens of correspondents in the second half of the nineteenth century. Mixing personal, political, academic and mathematical matters, as well as views on mathematics and its development, these letters offer a vivid picture of the mathematical landscape of the time. Particularly interesting is the fact that many themes appear repetitively between several correspondents, or, on the contrary, are adapted according to their own views and positions in the community. Such echoes and contradictions are particularly evocative, but also constitute a challenge to a potential editor: neither strict chronology, nor restriction to one correspondent, allow us to take them into account. The presentation will discuss these problems and some solutions while focussing on the exchanges between Hermite and the German mathematician Rudolf Lipschitz.

Session 28: Mathematical Correspondences and Critical Editions (v)

THE CORRESPONDENCE OF BARTEL LEENDERT VAN DER WAERDEN (1903-1996)

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The correspondence of van der Waerden is housed in the Library of the Eidgenössische Technische Hochschule (ETH) in Zurich and amounts to about 15,000 letters, stretching from 1943 until his death. All his previous documents were destroyed during a bombing raid in Leipzig in December 1943. The largest part of the Zurich collection was donated by van der Waerden himself to the ETH in 1982 after his resignation as head of the small department for history of science within the Institute of Mathematics at the University of Zurich. This part is fully catalogued and is also available as a 209-page inventory on the Internet (http://e-collection.library.ethz.ch/view/eth:22078). Other parts, which came to the ETH only later, or which remained in van der Waerden's possession until his death together with his scientific papers, are not yet catalogued and are, therefore, not open to the general public. E. Neuenschwander is currently preparing a partial edition of the correspondence together with an appreciation of van der Waerden's scientific and administrative activities in his Zurich years.

The present paper will give an overview on van der Waerden's literary estate in Zurich and document the communication between scientists and the transmission of scientific ideas in the 20th century. We will demonstrate that many of van der Waerden's theories in the history of science were built on the extensive source studies of Otto Neugebauer, Ernst F. Weidner etc. in ancient astronomy and mathematics, and his scientific exchange with David Pingree and Walter Burkert among many others. On the other hand, the correspondences with Heinrich Behnke, Richard Courant, Heinz Hopf, Friedrich Karl Schmidt, Clifford Truesdell permit many insights into the editing of journals in mathematics and history of science.

Session 28: Mathematical Correspondences and Critical Editions (v)

MODELING THE SPACE OF MATHEMATICAL INVENTION WITH THE ONLINE EDITION OF POINCARÉ'S PAPERS

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While Henri Poincaré's landmark contributions to mathematics, astronomy, theoretical physics, and philosophy of science are well-known to scientists and scholars, the paths Poincaré followed to make these discoveries remain largely a matter of speculation. The online edition of Poincaré's papers, including correspondence, research and lecture notes, illuminates these intellectual trajectories, which wind through the books, periodicals, and scientific reunions of the late-19th and early-20th centuries. My talk will focus on how the Poincaré Project creates a space for modelling Poincaré's creative process, using Poincaré's solution of a dynamical mixing problem (1911) as a case study.

Session 29

MATHEMATICAL SPECIALIZATION, EDITORIAL STRATEGIES AND AUDIENCES OF 18TH TO 20TH-CENTURY PERIODICALS - (SESSION 1)

Organizers: Hélène Gispert, Philippe Nabonnand, Clara Silvia Roero

The history of learned journals begins in 1665 with the creation in Paris of the *Journal des sçavans* immediately followed by *the Philosophical Transactions* in London, in both of which mathematics was present, as in most learned journals created after them. From the beginning of the 18th century, mathematics has not always been enthusiastically welcomed by the editors of the *Journal des savants*, whereas the *Acta eruditorum* of Leipzig played the role of a specialized periodical for the mathematicians involved in Leibniz calculus. In parallel, the *Ladies' Diary* was created in London at the beginning of the 18th century. This was an almanac whose success over a century and a half was ensured by its mathematical portion which contained arithmetical questions and "enigmas". The question of an audience or a market large enough to support a journal devoted to only one discipline thus arises from the very beginning of the history of journals. This decision to place audiences at the heart of our analysis, stipulating that the creation and the success of a journal are related to the existence of an audience, makes it possible to reexamine from a fresh standpoint the question of the specialization of these journals. This may then contrast with a traditional historiography which maintains that professionalization of scientists, and in particular of mathematicians, said by some to take place at the end of the 18th century and by others at the beginning of the 19th century, is the starting point of the process of specialization of the mathematical press, rather than a new form of an existing process. Throughout the 19th and 20th centuries mathematical journals multiply, corresponding to the increases in mathematical production, in the number of mathematical practitioners, and in the variety of educational institutions. After the *Annales de mathématiques pures et appliquées* that their editor, Gergonne, presented in 1810 as the first periodical miscellany devoted to mathematics, other specialized journals were created in Germany, in France, in Italy, and then in England, to publish research papers in mathematics. In parallel another process of specialization took place, with the creation of journals whose editors, audiences, and authors belong to specific professional milieux – teachers, engineers, military officers – and further, starting from the end of the 19th century, of journals dedicated to particular mathematical fields. This symposium is devoted to these processes of specialization studied over the long term, from the very beginning of the 18th century until the first half of the 20th century. It presents research being carried out within the framework of international projects on the circulation of mathematics and its audiences in various geographical areas. The papers of the symposium's two sessions will be dedicated to different dynamics of mathematical specialisation in and via journals, as well as to aspects of the segmentation dynamics of the journals' audiences. Addressing the study of journals by asking questions about their audiences allows a reconsideration of an historiography too exclusively centred on authors, by also taking into account their readers and users.

Session title: Mathematical specialization, editorial strategies and audiences of 18th to 20th-century periodicals

MATHEMATICAL WORK AND MATHEMATICAL PUBLICS AS REFLECTED IN GERMAN-LANGUAGE PERIODICAL LITERATURE, 1785-1830.

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Abstract

With the professionalization of research mathematics in universities during the nineteenth century, the distinctions between research and practical production became quite clear. This was not at all the case in the immediately preceding period, and the very nature of creative research in the mathematical sciences during that period is quite murky. What are the differences between research and practice? between mathematical creation and recreation? Looking at the periodicals that published mathematical literature in German in the years from the death of Frederick II until the eve of the establishment of the Zollverein, we gain an understanding of the publics that engaged with periodical literature containing or specializing in mathematical articles. This period spans the Napoleonic Wars, decisive for the European history of the period. It also begins with what are generally considered the first specialized mathematical periodicals, edited by C. F. HIndenburg , and concludes with the early years of Crelle's journal.

By looking at these and other periodicals, we look not only at the publics for mathematics, but also at the role of publication in the career strategies of various mathematical writers of this period. We will examine shifts in publication practice by authors, in the nature of mathematical articles, and in the role of mathematical publishersalmanac, was due to its mathematical questions, which awoke the curiosity of a large audience putting the journal on a firm financial basis. The link to a profession may also support a specialised journal, as is the case with Magazin für die Bergbaukunde, created in 1785, which offers an example of a journal addressed to a profession (mining) and partly dedicated to mathematics. In all the examples to be considered, the success of a specialisation process depends among others on the existence of an audience, may it be a lay audience or a mathematical profession.

Session title: Mathematical specialization, editorial strategies and audiences of 18th to 20th-century periodicals

MATHEMATICAL PUBLISHING AND SPECIALIZATION OVER THE LONG TERM IN 18TH TO 20TH-CENTURY JOURNALS: THE AUDIENCES

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Abstract

The traditional historiography of specialization of journals, in particular in mathematics, has long been presented as a linear history. Beginning with the creation of the learned journals (17th century), one would have attended a first stage of specialization with the advent of journals devoted to only one discipline - at the end of the 18th century or at the beginning of the 19th century for mathematics -, and at a second stage, with the creation of journals devoted to sub-disciplines (from the end of 19th century onwards). Such a vision, centered mainly on publications dedicated to research, does not give an account of the diversity of the mathematical journals, of their audiences (including the public of authors), of their uses, which have existed during this long time in various areas.

We propose to break with this vision and consider the specialization of a journal according to the aims of its editors and the uses audience(s) to which it addresses itself could have. Then the category of specialized mathematical journal becomes more and more complex, diversifies, according to the specialization of editorial projects and to the segmentation of target audiences, communities of authors and readers who take hold of the journals.

The history which one can make can be any more, in no way, a linear history. Thus, from a synchronic point of view, the editorial offer in mathematics at different times of this long term period, particularly from the 19th century, presents a range of journals and uses to write, read, learn, practice, utilize mathematics. From a diachronic point of view, taking into account the different geographical and cultural areas incites to describe editorial dynamics both in countries usually considered the center of the mathematical world of the 19th century and in those thought up to now on its margin.

Session title: Mathematical specialization, editorial strategies and audiences of 18th to 20th-century periodicals

MATHEMATICAL SPECIALISATION IN 18TH-CENTURY JOURNALS: EARLY ATTEMPTS AND THE QUESTION OF THE AUDIENCE

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Abstract

The paper will be devoted to the study of early attempts of mathematical specialisation of/in learned journals from the 18th century. What may specialisation mean in a century when disciplinary communities were only about to develop and when learned periodicals were of generalist content? At the hands of examples, the paper will investigate this notion and show that the dynamics of specialisation was present in various forms since the creation of the first learned journals. Most of the latter titles included some mathematical information, as the example of the *Journal des sçavans* or *La Clef du Cabinet des Princes* show. Periodicals like the Leipzig *Acta eruditorum*, or to a lesser extent the Italian *Giornale de' letterati*, built specific editorial strategies, which allowed the small nascent community of Leibnizian analysts to use them as their privileged means of communication. From the start, a demand for specialised journals was vivid among mathematicians. Early attempts of a disciplinary specialisation existed, as the example of Antoine Parent's *Recherches de physique et de mathématique* (1703-1713) indicates. The reasons for its failure will be discussed, while at the same time period, the immense popularity of the British *Ladies' Diary*, initially established (in 1704) as an almanac, was due to its mathematical questions, which awoke the curiosity of a large audience putting the journal on a firm financial basis. The link to a profession may also support a specialised journal, as is the case with *Magazin für die Bergbaukunde*, created in 1785, which offers an example of a journal addressed to a profession (mining) and partly dedicated to mathematics. In all the examples to be considered, the success of a specialisation process depends among others on the existence of an audience, may it be a lay audience or a mathematical profession.

Session title: Mathematical specialization, editorial strategies and audiences of 18th to 20th-century periodicals

A JOURNAL FOR SAILORS AND MATHEMATICIANS PRACTITIONERS : THE NAUTICAL ALMANAC AND ASTRONOMICAL EPHEMERIS (1767-1828)

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Abstract

The “Nautical Almanac and Astronomical Ephemeris” was published from 1767 by Nevil Maskelyne via the *Board of longitude*, the commission instituted in 1714 by Queen Ann to solve the longitude problem on sea. The Almanac is an annually published ephemeris giving the positions of heavenly bodies for stated points in time and has provided essential data to navigators, geographers and astronomers. The tables also contained everything essential for a “general use” and its users had practically to be skilled on mathematical and even technical knowledge.

This talk will consider the Almanac in relation with the *Board of longitude* and the strategies developed by Maskelyne to diffuse astronomical method in longitude computation. Keeping my attention on audiences, I’ll consider how, in 1828, the specialization of the Almanac asked by some of its audiences, i.e. mathematician practitioners or astronomers, eventually caused the dismantling of the *Board of longitude*.

Session title: Mathematical specialization, editorial strategies and audiences of 18th to 20th-century periodicals

SEARCHING FOR MATHEMATICS WITHIN FRENCH ENGINEERING JOURNALS IN THE 19TH CENTURY

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Abstract

It is now a well-established fact that a significant minority of *polytechniciens* in the long 19th century availed themselves of the teaching they received while at *Ecole polytechnique* and its various applications schools, to conduct pioneering work in various areas of mathematics. Vast swathes of mathematics produced by graduates of *Ecole polytechnique* were published in the many engineering journals that were founded in the first third of the 19th century. Among these journals, *Annales des Ponts et Chaussées (APC)* probably stands out from the rest in respect of the quantity of (high-level) mathematics it contained. It must be noted, though, that most of this mathematical production, far from constituting an autonomous body of knowledge, was rather a key component of practice-oriented studies dealing with the various scientific and technical areas embraced by the *Ponts et Chaussées* engineer of the time, such as hydraulics and strength of materials, road and water systems, or bridges and buildings.

The case of nomography illustrates well this interplay and intermingling of mathematics and engineering concerns within *APC* in the 19th century. Charged with the repetitive and highly time-consuming task of estimating "cut and fill" volumes, *Ponts et Chaussées* engineers had recourse massively to various original calculation techniques over the 19th century and the early 20th century. Although geared towards practical applications, these estimation techniques nevertheless formed a fertile breeding ground for the creation of a new mathematical area called nomography. Building on the many articles tackling the "cut and fill" issue that were published in *APC*, this proposal aims at analysing the long road to nomography, and in doing so, at casting light on the ways engineering journals functioned as significant sites of knowledge production and diffusion in the field of mathematics during the 19th century.

Session title: Mathematical specialization, editorial strategies and audiences of 18th to 20th-century periodicals

SOME ASPECTS OF THE DIFFUSION OF TENSOR ANALYSIS IN POST-UNITARIAN ITALY JOURNALS

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Abstract

The subject of this communication concerns the way in which the papers in tensor analysis were published in Italian scientific journals in the various stages of the development of the theory, both before and after its use in general relativity. This subject can be viewed as an historical example of the relationships between the process of specialization of scientific thought at work throughout the nineteenth century and the presence of cultural and scientific Academies with their journals covering many different research fields.

In effect, the explicit appearance and the first developments of tensor analysis were essentially connected to the school of G. Ricci-Curbastro and T. Levi-Civita in Padua in the late 19th and early 20th century, with the journals *Atti del Reale Istituto Veneto di scienze, lettere ed arti* and *Rendiconti della Reale Accademia dei Lincei. Classe di Scienze fisiche, matematiche e naturali* as its principal means of diffusion. On the other hand, as regards the development of the theory in Italy, it is also possible to observe an increasing presence of papers published in journals more specifically devoted to mathematical subjects; an aspect that is testified by the role played in this context by the *Rendiconti del Circolo Matematico di Palermo*, in which for example the paper by Levi-Civita on parallel transport were published in 1917.

Session title: Mathematical specialization, editorial strategies and audiences of 18th to 20th-century periodicals

ADAPTING PUBLISHING STRATEGIES TO THE DIVERSITY OF EDITORIAL OFFER. THE CASE OF MATHEMATICS IN FRANCE (1810-1835)

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Abstract

This talk aims at looking at the importance of publishing in scholarly life in France at the beginning of the 19th century. At a time when the role of the académie des sciences was changing, when publishing houses producing textbooks started emerging, and when science gained a stronger presence in the general press, how did mathematicians gain their scientific legitimacy ? I will examine how the emergence of various publishing venues allowed the coexistence of several procedures whereby scientific contributions are validated and accepted. Using printed sources aimed at different groups of readers (academic publications, journals, textbooks and periodicals for students and teachers), I will analyze the publishing strategies used by aspiring scholars and show how they could paradoxically attempt to address a non academic readership to make their work accepted and their scientific contribution validated by the mathematical community.

Session title: Mathematical specialization, editorial strategies and audiences of 18th to 20th-century periodicals

TEACHING AND DIVULGATION OF MATHEMATICS IN SAVOYARD AND ITALIAN PEDAGOGIC PERIODICALS (1845-1920)

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Abstract

In the last years of the 19th century, the Italian Kingdom saw the flourishing of periodicals specialized in mathematics teaching, such as the Bollettino della Mathesis (1896-1920) and the Periodico di Matematica (1886-1918). However, the very roots of this scientific and educational fervor, which involved scientists and pedagogues of high level, date back to the second half of 19th century.

From the study of the pedagogic periodicals' succession –risen up after the liberties brought on by the Albertine Statute in Sardinia Kingdom - and, in particular, focusing on their initiatives to increase teachers' pedagogical competences and scientific knowledge, we gain an overview of the growing participation of specialized editors, mainly pedagogues, increasingly supported by scientists and professors from the Faculty of Mathematical and Physical Sciences of Turin.

By sustaining an innovative pedagogical approach influenced by foreign experiences, and promoting its direct application into the schools, periodicals such as the Giornale della Società d'Istruzione e di Educazione (1849-54) and L'Istitutore (1852-93) addressed teachers who not only needed a concrete support and a professional education upgrade, but also a specialized and distinguished milieu of collaboration and free divulgation of ideas and knowledge.

By analyzing the evolution of readers' typology and topics - and its switch from an initial orientation on the political liaisons and debates to an increasing clustering of mainly technical topics suitable to specific scholastic levels and disciplines - we gather a brand new way of promoting scientific divulgation, aimed to the enhancement of education in both a theoretical and pragmatical aspect. An evolution, which can be considered as the root of mathematics' teachers associationism as well as the start of a more modern way of teaching Mathematics in the Italian Kingdom of the first years of the 20th century.

Session 30

COMMUNICATING HEALTH: MEDICAL RISK FACTORS IN PUBLIC DEBATES

Organizers: Hieke Huistra, Toine Pieters

This session explores how medical risk factors were constructed and communicated in public debates in the long twentieth century. Medical risk factors, or health risks, are flexible entities, located on the boundary zone between health and illness, with multiple and changing meanings. Alcohol consumption, cigarette smoking, high blood pressure, physical inactivity and fatness all somehow became regarded as risk factors in the twentieth century. Through different forms of communication, such risks became publicly identifiable as large enough to warrant some time and attention: newspaper articles, advertisement campaigns, insurance policies, visits to the doctor, and television shows, to name a few. The papers in this session investigate health risks in various forms of communications, places and periods, which enables comparisons and helps us to answer questions like: How did health risks circulate in the public sphere? How were risk factors constructed in those communications? How did the multiple and changing meanings of risk factors vary between and depend on the means of communication? How did the producers and audiences of these communications co-construct risk factors?

Session title: Communicating Health. Medical Risk Factors in Public Debates

ENGINES OF COMMUNICATION? EPIDEMIOLOGICAL RISK SCORES IN THE MAKING

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Abstract

In this paper we investigate epidemiological risk scores as tools of health communication at the turn of the twenty-first century. Risk scores are calculative devices derived from epidemiological studies and used in medicine and public health for treatment decisions, identification of populations at risk and as benchmarks in preventive medicine. We investigate the coproduction of these calculative devices in political, scientific and societal venues, and follow the ways in which they become mobilized and circulate. Our empirical case study investigates health communication efforts in the process of recruitment and participation of a large-scale cohort study in Germany as well as the data flows, infrastructures and research logistics within this study. Our approach to study risk scores both in the making and in their mobilization in society makes visible the ways in which data infrastructures of population studies shape health research, policy and public health. In this sense, we examine how risk reasoning brings about specific modes of thinking and doing health in everyday life. Risk scores thus become visible as devices that shape health policies and actual lives within a specific dispositive of prediction.

Session title: Communicating Health. Medical Risk Factors in Public Debates

ADVERTISING FATNESS: BODY SIZE AS A HEALTH RISK IN DUTCH NEWSPAPER ADVERTISEMENTS, 1900–1950

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Abstract

This paper analyzes how newspaper advertisements shaped the idea of fatness as a medical risk factor in the first half of the twentieth century. Throughout the twentieth century, fatness (also known as corpulence, obesity, plumpness and overweight, depending on the period and discourse) was considered a health risk not only in the medical but also in the public sphere. This idea circulated in the public sphere through different means of communication, but, at least in the first half of the century, in particular through advertising campaigns. Companies trying to sell products like slimming drugs, diet books, bathroom scales and special foods presented fatness as a problem that needed solving, and framing it as a health risk was a powerful way to do this. However, it was not the only way: a second major frame was that of fatness as an aesthetical problem. Which frame was used when depended on many factors, including the particular product advertised, the advertiser, the newspaper, the gender of the target audience, the prevailing fashion and contemporary medical ideas.

To explain when the interplay between these factors resulted in adoption of the medical frame, and when it did not, this paper analyzes several advertisement campaigns in Dutch newspapers between 1900 and 1950. In doing so, it aims to improve our understanding of the construction of fatness as a health risk in public debate

Session title: Communicating Health. Medical Risk Factors in Public Debates

‘DISAPPOINTING THE UNDERTAKERS’: CALCULATING AND COMMUNICATING THE RISKS OF DRINKING IN ANGLOPHONE LIFE ASSURANCE, 1870–1930

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Abstract

By the 1870s the mortality records of some British life assurance companies appeared to show that their policyholders’ habits affected their longevity; as one actuary put it, ‘those who don’t drink, don’t die so fast.’ Using this data to calculate the risk of drinking, companies on both sides of the Atlantic offered abstainers better deals than moderate drinkers, while refusing to insure publicans altogether. As the industry grew rapidly at the end of the century life assurance became an important source of evidence for the idea that alcohol was harmful, for a wide cross-section of society.

Applicants for life assurance would learn about these risks through conversations with the doctors who were paid to examine them; others would see these figures reproduced in temperance publications, or in ordinary newspapers – in firms’ advertisements, obviously, but also in letters to the editor, the business pages (discussing the superior bonuses enjoyed by teetotal policyholders), and in reports of Parliamentary debates or meetings of the British Association. Even sensational fraud cases involving allegations of secret drinking advertised both the dangers of alcohol and the health and financial benefits of abstinence. It seems likely, then, that the construction of drink as a particular kind of risk owed a good deal to the ideas and practices of the life assurance industry.

This paper will outline the nineteenth-century development of temperance life assurance and the ways it communicated the idea of drinking as a health risk, and then examine the ways in which these figures and methods were subjected to scrutiny by the state, academic researchers, and the industry itself in the first three decades of the twentieth century.

Session title: Communicating Health. Medical Risk Factors in Public Debates

'A REMARKABLE DEGREE OF PUBLIC AWARENESS': COMMUNICATING LUNG CANCER RISK IN 1950s BRITAIN

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Abstract

The association between lung cancer and cigarette smoking, supported by a series of epidemiological studies since the late 1940s, provides us with a prime example of risk factor thinking. While critics argued that statistical evidence was not sufficient to show causation, studies such as those undertaken by Doll and Hill in the UK demonstrated clearly that cigarette smokers were more likely to suffer from lung cancer than non-smokers. In the early 1950s the great majority of men in the UK were at least occasional smokers, and these results were covered widely by the British press, along with calls for a policy response. In this paper I will focus specifically on how the risk of premature death by lung cancer associated with the habit of smoking was communicated to the British public, and how this risk was perceived at various points in time. Looking especially at the results of a survey organised by sociologists to accompany an antismoking campaign in Edinburgh in 1958, I will argue that, while understandings of the associated risks were not sophisticated and often idiosyncratic, a majority of smokers had some concept of the dangers to health associated with the habit by the late 1950s.

Session 31

ASPECTS OF COOPERATION BETWEEN PORTUGUESE AND SPANISH SCIENTISTS IN THE MATHEMATICAL AND PHYSICAL SCIENCES

Organizers: José Miguel Pacheco, Luís Saraiva

The long history of the Iberian countries not only has characteristics that distinguishes them from other European countries, but also shows that they have many common points. However, studies offering particular joint analyses of the Iberian countries stressing their mutual connections and interactions in the fields of science and its transmission are scarce. Rarely joint historical episodes have been properly analysed and studied.

This session is deemed to convey a general picture stressing the role of scientific activities in the mutual relationship of both countries. Theoretical science, as well as applied topics, even some close to engineering, will be dealt with in this session. Emphasis will be made on parallelisms, cooperation episodes, and why not, also on missed opportunities and on failures in understanding each other. We expect to attract attention both to overarching questions and also to particular case-studies, thus contributing to better understand Iberian science from a unified viewpoint.

Session Title: Aspects Of Cooperation Between Portuguese And Spanish Scientists In The Physical And Mathematical Sciences

LAVANHA, A PORTUGUESE SCHOLAR AT THE SPANISH COURT

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Abstract

João Baptista Lavanha was born by the middle of the sixteenth century. He started his career as mathematician when king Phillip II, from Spain, became king of Portugal. Lavanha was the first professor of mathematics at the newly established *Academia de Matemáticas*, in Madrid. He assumed this duty in the first day of 1583. In 1591 he returned to Lisbon to assume the duty of Cosmographer-major from the Kingdom of Portugal. In 1599 (or 1600) Lavanha went back to Madrid and stayed in Spain for the rest of his life. He returned once to Portugal, in 1619, accompanying king Phillip III (of Spain) in a voyage to the kingdom of Portugal. Lavanha died in 1624.

Living all these years in Spain, the most part of them in Madrid, Lavanha was very close to the Royal Family. He taught mathematics to the future kings Phillip II and Phillip III, when they were young princes, to several noblemen, and also to other important persons in Spain, like the poet Lope de Vega. Despite his connection to the Spanish court, Lavanha was always a champion of Portuguese causes.

In this paper we will present a short biography of Lavanha. Then we will talk about one issue showing this attitude of Lavanha, defending Portuguese causes. The Treaty of Tordesilhas divided the world into two hemispheres. Magellan tried to prove that the Moluccas stood in the Spanish hemisphere. Almost one century after Magellan's voyage, this issue was not solved. Lavanha defended that these islands were Portuguese, against the opinion of Garcia de Cespedes, who tried to prove that they belonged to Spain.

Session Title: Aspects Of Cooperation Between Portuguese And Spanish Scientists In The Mathematical And Physical Sciences

DISSEMINATING HISTORY OF SCIENCE FROM ULTRA-PERIPHERAL EUROPE. THE CASE OF THE *FUNDACIÓN OROTAVA DE HISTORIA DE LA CIENCIA*

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Abstract

The scientific community has used all available means to publicise its discoveries, researches and proposals. Since the birth of modern science it was deemed necessary for such communication processes to take place among the protagonists of scientific activity, but also to target general public and social institutions. Scientists have made use of correspondence, publications, more or less academic meetings, the media, or the web. During the twentieth century, scientific communication transcended research producing environments, thanks to its social success over the prior two centuries. The decades after World War II witnessed the origin of European and American associations, institutes or university specialisations aiming to communicate all aspects of science.

However, incorporation to this field of European territories far from the metropolis was harder, but not less fruitful. In a European overseas region as the Canary Islands, a project born in 1991 was eventually institutionalised in1999: The *Fundación Orotava de Historia de la Ciencia* , initiated in Tenerife thanks to the personal efforts of a group of teachers from different fields, not as an official or university initiative. For more than two decades, History of Science has enjoyed an interdisciplinary approach based in the Canary Islands, extending to Europe and the Americas and targeting different audiences: researchers, university students or schools. Unfortunately, the current situation in southern Europe has slowed down its activity and dramatically decreased its dimensions. Hopefully, this symposium will be the right place for establishing new cross-national synergies.

Session Title: Aspects Of Cooperation Between Portuguese And Spanish Scientists In The Mathematical And Physical Sciences

PLANS Y FREYRE AND THE RECEPTION OF RELATIVITY IN PORTUGAL

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Abstract

The Eighth Congress of the Spanish Association for the Progress of Science took place in Oporto, Portugal, as a joint Meeting with the First Congress of the Portuguese Association for the Progress of Science, in 1921. The inaugural address of the first Session, Mathematical Science, was delivered by the mathematician José Maria Plans y Freyre, of the University of Madrid. In his speech, entitled “Historical Process of the Absolute Differential Calculus and its current importance”, the author acknowledges the work of some Portuguese scientists, such as, Pedro Nunes, whom he dubbed as “the prince of mathematicians of the Iberian Peninsula”, and Daniel Augusto da Silva, who he considered as one of the most distinguished scholars. He then proceeds to justify the relevance of his address.

According to Plans y Freyre, Einstein's theory was the most significant scientific event at the time, so it was clear that no other issue was more appropriate to be discussed in the meeting. Taking into account the analytical methods employed by general relativity, the author presents a long introduction to the history of mathematics in its interaction with science, and particularly with mechanics, astronomy and physics, stressing the geometrical methods developed by Gauss, Riemann, Christoffel, Ricci and Levi-Civita. While this address is usually considered to be the first formal introduction of general relativity in Portugal, so far no historical analysis of its real impact has been provided. In this talk, I will explore in what ways this address acted as the starting point for the establishment of networks involving Portuguese mathematicians and Plans y Freire, and as a means for the appropriation of general relativity into the educational realm, and specifically in informing the outline of the syllabus of the first course on General Relativity delivered at Portuguese universities.

Session Title: Aspects of cooperation between Portuguese and Spanish scientists in the mathematical and physical sciences

A SPANISH-PORTUGUESE RESEARCH CONNECTION: JULIO PALACIO'S SUPERVISION OF TWO LABORATORIES AT LISBON UNIVERSITY

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Abstract

Julio Palacios, physics professor of the University of Madrid, was a researcher of Junta para Ampliación de Estudios e Investigaciones Cientificas (Board for Developing Studies and Scientific Investigations) and of its successor, in 1939, Consejo Superior de Investigaciones Científicas (Higher Council for Scientific Investigations). In 1947, following the dismissal allegedly for political reasons of three physicists of the Laboratory of Faculty of Sciences of Lisbon, Palacios was invited to head physics research at this Laboratory. To his surprise he found that the physicists with whom he had entertained very good scientific relations were gone forever. His research achievements, acknowledged by the Portuguese scientific community from start, led to another invitation, in 1952, to install and supervise a Center for Nuclear Physics Studies at the Instituto Português de Oncologia (Portuguese Cancer Institute), the Cancer Hospital of the University of Lisbon.

This paper has two aims. The first is to enlighten the situation involving Palacios's privileged contacts with Portuguese research institutions which led to the first invitation, in the context of the Portuguese-Spanish dictatorial relationship and Palacios's right wing stand. The second is to discuss the relevance of Palacios's research agenda in Portugal, especially in what concerns the application of radioisotopes to cancer treatment. I will show how he succeeded in assembling a group of Portuguese researchers that left their imprint on the Portuguese research landscape.

Session Title: Aspects of cooperation between Portuguese and Spanish scientists in the mathematical and physical sciences

A *"PROBLEMATIC" GUY:* THE SPANISH MATHEMATICIAN JOSÉ GALLEGO-DIAZ (1913-1964)

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Abstract

This contribution is dedicated to the mathematical life and scientific endeavour of José Gallego-Díaz, a Spanish engineer and applied mathematician whose career took place between the early 1930s and 1965 in three very different political and social environments: The Spanish Republic and the civil war, then Franco's dictature from 1939 until 1956, and finally in the Americas. Although he was politically involved in the first two stages –a republican who had some official responsibilities during the civil war, then an opponent to Franco's regime-, regardless of political regimes he was able to develop a body of mathematical ideas and applications that really deserves being considered a breakthrough in the Spanish mathematical panorama, not very prone to applied Mathematics in those times.

Gallego-Díaz contributed to mathematical Biology when this discipline was in its infancy, and made some original studies to the mathematisation of certain fields of economic theory. Curiously, for years his main outlet for publication was in Portugal: He was a regular contributor to *Gazeta Matemática* and *Revista de Economía*, while he never published anything in the Spanish flagship journal *Revista Matemática Hispano Americana*. He was also an uncommon teacher who enjoyed problem proposal and elegant solutions, and is still remembered through some of his books on problem-based approaches to mathematical topics. In addition to all that, he wrote on many occasions on very different fields, and left behind him an abundant collection of notes, reviews, recensions, and other materials of non-mathematical

Session Title: Aspects Of Cooperation Between Portuguese And Spanish Scientists In The Mathematical And Physical Sciences

THE PORTUGUESE MATHEMATICIANS AND THE FIRST IBERIAN CONGRESSES FOR THE PROGRESS OF SCIENCE (1921-1932)

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Abstract

In this talk we intend to analyse the contribution of Portuguese mathematicians to the Iberian Congresses for the Progress of Science that were held in the twenties and early thirties of the 20th Century, and the interaction with their Spanish counterparts. We start with the opening Congress in the city of Porto, Portugal, in 1921, and our analysis ends with the Lisbon Congress of 1932. In between we have congresses in Spain – Salamanca, in 1923, Cádiz, in 1927 and Barcelona, in 1929 – and in Portugal – Coimbra, in 1925. We will analyse in more detail the work of Francisco Gomes Teixeira (1851-1933) and Pedro José da Cunha (1867-1945), the former the most important Portuguese mathematician of this period, the latter the future first president of the Portuguese Society of Mathematics, both were important members of the Portuguese delegations which participated in these congresses.

Session 32

SCIENCE FOR CHILDREN

Organizer: Isabel Zilhão

The symposium *Science for Children* attempts to discuss how science has been used for shaping tomorrow's citizens in various places and at various times and to bridge the gap between scholars with different backgrounds and perspectives working on this topic. The symposium will be divided in three sessions. The session *Popular Science for young people* continues the session *Science for youngsters in the long nineteenth century* into the twenty-first century. Isabel Zilhão's presentation focuses on a collection of seven books on agricultural science published at the turn to the First Portuguese Republic, and where young readers learned about new farming methods mixed with religious, moral and social messages. Peter Bowler discusses how the *Meccano* magazine articles extended from model construction to wider themes in science and technology in inter-war Britain. Melanie Keen shows how dinosaurs have been "surviving" in children´s books from Victorian times to present day. Marta Carli presents PLaNCK!, a contemporary popular science magazine for kids in Italy where children have an active part in the project. The mathematician (and historian of science) Felipe Ramirez gives a personal account of his experience as a popularizer of science in the Spanish daily press.

Session Title: Children's Science Education Across Time And Place

AMERICAN CHILDREN EXPLORE THE ATOM, 1945-1958

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Abstract

The Atomic Age in the United States, which began with the dropping of the atomic bombs on Japan in August of 1945, inspired hopes, fears, and a public interest in science. The science of the Atomic Age generated hopes for the production of unlimited electrical power and miraculous medical cures. At the same time, this science and the weapons that were its result evoked fears of worldwide nuclear war and revealed the need for civil defense initiatives. The words 'atomic' and 'nuclear' became marketing phrases used to sell goods like clothing and dishware as well as the basis for science fiction. The public attention to nuclear possibilities challenged scientists, politicians, and the growing nuclear industry to explain atomic science and

its implications to the general population of the United States. Over the next decade and a half, multiple aspects of atomic science – including atomic structure, isotopes, radiation, and fission – were featured in a variety of media aimed both at the formal education setting as well as the general public.

While most of these educational materials were developed for high school students and adults, the education of young children – those who would be inheriting this atomic world – was seen as an important endeavor. While some materials presented the science removed from the cultural context, most of these materials, which included textbooks, popular press books, comic books, and films, worked to provide children an understanding of the structure of atoms, discussions of the promises of the nuclear future, and, in the case of civil-defense films, a plan for survival under nuclear attack. Though simplified and often presented with cartoon-style illustrations, these materials presented children a view of the atomic world that was consistent with the message given to American adults.

This talk will compare the atomic science content and overall atomic age message of the materials prepared for children in the immediate post-World War II period with those aimed at older audiences to discuss the role of children in the atomic age, the cultural importance of atomic science, and the role of science education to the public in this time.

Session Title: Children's Science Education Across Time And Place

THE EVOLUTION OF TEACHING COLLECTIONS ACROSS DIVERSE POLITICAL REGIMES IN PORTUGAL, 1836-1975

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Abstract

The underlying model of what is now meant by *secondary education* emerged in the nineteenth century. The idea of a public and secular institution to prepare citizens for higher education proliferated throughout Europe giving rise to different organizational models as a result of different situations in various countries.

Portugal was no exception in this scenario and, as the liberal ideals increasingly found support in Portuguese society, science and education became fundamental issues. The strong interest in science is reflected by the 1836 decree. This date marked a critical point in the creation of a modern educational system, where science teaching was included. This proved to be also the turning point in the development of scientific collections that were considered essential to improve the teaching of science.

Collections played, indeed, a key role in the first systematic introduction of scientific disciplines into secondary schools. They were largely recognized as a fundamental method for studying the natural world and, therefore, had a remarkable importance in the teaching practices of life and earth sciences during the 19th and 20th centuries. At the end of the nineteenth century, the core of a typical natural history teaching collection would include naturalized zoological specimens, herbaria and geological, mineralogical and fossil collections. In Portugal, from the first years of the twentieth century onwards, new didactic materials, like microscopes, were introduced. Was this a response to a new political regime that in 1910 implanted a Republic in Portugal? Or was it a consequence of scientific or pedagogical developments?

This paper provides a historical account of the development of secondary education in Portugal, during the nineteenth and twentieth centuries, a period that encompassed a monarchy, a republic and a dictatorship. The focus will be on the contemporary establishment of natural history teaching collections. Using multiple sources - bibliographical, documental, and material – it traces the origins of these collections, documents their constitution, organization and use through time and, in particular, examines how the political, scientific and pedagogic environments influenced the development of both the curriculum and the collections between 1836 and 1975.

Session title: Children´s science education across time and place

STAGING SCIENTIFIC OBJECTS IN THE 'SCHOOL OF PLAY,' 1650-1750

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Abstract

"John Amos Comenius (1592-1670) is perhaps best known today as the creator of the Orbis Sensualium Pictus—or The World in Pictures—a popular visual encyclopedia containing evocative images of things in the world. Scholars have long agreed that the Orbis Pictus contributed to a heightened interest in using children's encounters with objects (real or imagined) to improve their ability to learn Latin and other languages. While Comenius was especially interested in responding to the specific issue of language acquisition in young people, I will argue that he also wanted to help them better apprehend the workings of the natural world. In effect, he was trying to promote a reliable and engaging way to make new scientific knowledge accessible to children. Comenius explained his approach in a series of plays entitled the Schola Ludus, or "School of Play." These plays actually consisted of speaking parts for an array of natural objects along with representatives of various professions and ancient philosophers; they were performed in schools throughout eastern and central Europe and inspired several educational reform efforts, including those of Andreas Reyher (1601-1673) in the German city of Gotha. After some discussion of the performance of scientific knowledge in and through these "object-centered" plays, I will consider how Reyher in particular attempted to more deliberately inspire young people to become scientific observers through object lessons—efforts that were ongoing throughout the seventeenth and on into the eighteenth centuries and culminated in the founding of the first "schools of real" or Realschulen in Central Europe. These schools must be understood as much more than vocational schools; rather, they were early scientific workshops or laboratories designed to include young people in ongoing efforts to devise and to standardize new scientific methods and technologies."

Session title: Children´s science education across time and place

INTEGRATING IDEAS AND IDEOLOGIES IN THE CLASSROOM: UNESCO'S PROGRAMME IN INTEGRATED SCIENCE TEACHING 1969-1983

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Abstract

In 1961, physicist (and father of singers Joan Baez and Mimi Fariña) Albert Baez moved from California to Paris to become the first director of UNESCO's Division of Science Teaching. Inspired by science education reforms in the United States lead by Jerrold R. Zacharias, Baez established UNESCO's program in science education with an emphasis on developing new science curricula and new approaches to the teaching of science. He learned from Zacharias that science education reforms were to be led by scientists who would design the content and methods of science teaching so as to provide learners with an appreciation of the basic sciences (physics, chemistry, biology and mathematics) and instill an inquiring attitude to the natural world. UNESCO supported Baez's ideas, particularly seeking to implement science education reforms in the developing countries. In 1969, UNESCO launched a worldwide programme in integrated science teaching at the junior level in collaboration with the International Council of Scientific Unions. The new director of science teaching at UNESCO, Stephen O. Awokoya, former minister of education in Nigeria, at the time argued that the new programme should promote scientific literacy as an essential element of modern life, providing children with scientific explanations to the wonders of nature and leading them to find out answers themselves by trial-and-error, by experiment and verification. The integrated approach to science teaching would integrate basic elements of the scientific worldview with the scientific method of inquiry, while also incorporating socio-cultural differences and the applications of science in everyday life. This paper traces the ideas and ideologies that shaped UNESCO's initiative in integrated science teaching and presents examples of how the integrated science teaching programme was carried out in practice.

Session Title: Science For Youngsters In The Long Nineteenth Century

WOMEN AND THE MATRIX OF SCIENCE IN THE NINETEENTH CENTURY

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Abstract

In 1913, the 63rd edition of Mrs. R. Ward's Child's Guide to Knowledge—greatly revised yet oddly familiar--was published in London. The book's remarkable run of 90 years--originating in the Regency--is all the more notable for the fact that this work, among the most successful popularizations of knowledge in the 19th century, is almost entirely forgotten. The author, Fanny Umphelby (1788–1852), who was responsible for the content and its catechetical format, followed the example (and the longevity) of Richmal Mangnall's (1769-1820), *Historical and Miscellaneous Questions for the Use of Young People* (1798), which was itself reprinted in 1908. These remarkable works, dealing with the dissemination of knowledge, are part of a vast "juvenile library," populated by authors, who are all on the margins of familiarity. Individual scholars can be forgiven for not knowing these names but collectively our lapse of memory illustrates how backward we are in terms of understanding science networks in the nineteenth century. As these works suggest, there was a matrix of scientific dissemination for children which we haven't even begun to comprehend. In this paper, I want to explore the significance of these works in the century that is at the heart of the scientific and industrial age. My other objective is to propose a system by which we can begin to reassemble this matrix of writers to understand them as workers in a field whose importance they well understood. As scholars, we now have the tools to collaborate in a manner that will render "science writing for children" a much more coherent area of study. There is no question that "canonical science" in the early nineteenth century was shaped within the social and discursive patterns of women's writing. And that must be a project for all of us.

Session Title: Science For Youngsters In The Long Nineteenth Century

SCIENCE FOR CHILDREN IN A COLONIAL SITUATION: BENGALI JUVENILE LITERATURE, C.1880- C.1920

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Abstract

Faith in British rule as the harbinger of progress based on scientific knowledge having eroded, by the late 19th century Bengalis increasingly preferred taking things in their own hands to affect changes. It coincided with the emergence of an extended childhood among a now sizeable middle class; the colonial school having failed, educating children anew became crucial to them. In a situation of distance and disparity, literature appeared to be the most effective option to get across to the children. And as the ideal was to forge them into imaginative, rational, and productive beings who would both take care of society and secure a place for their country in the modern world, instructing them in science became a major imperative.

In the juvenile literature of the period, the physical world was presented in all its quaintness – for the young to wonder at, to be amazed by, and to revel in. To enthuse them into action later, knowledge about it, as also all discoveries and inventions, were put down to human intellect and endeavour that have helped humans to dominate over nature and all creatures. It was also hoped that children develop a caring attitude towards all that sustains life on Earth and adds variety to it. Photographs, illustrations, and an engaging language were all expected to both entertain the readers and goad them into being inquisitive, observant, rational, and actively engaged with their physical surroundings.

Those who grew up reading this literature readily acknowledge that, at a time when the radio and the cinema were still to arrive, it was their sole link with the wide world, it was from this that they acquired all knowledge about it, and more important, it stoked their imagination, opened up their minds, and made them into thinking and creative individuals. But this literature, stressing science, intellect, and reason, could produce a bias too. It went against all other kinds of knowledge and people who were the repositories of such knowledge – the old, the illiterate, the lower orders, the rural folk, and women – all who were portrayed as either incapable of acquiring modern scientific knowledge or as not needed to by society. Science thus became matter of faith too, engendering a narrowness that goes against its very spirit.

Session Title: Science For Youngsters In The Long Nineteenth Century

TELLING THE "STORY OF LIFE" TO CHILDREN IN THE 1830s

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Abstract

Geology was a young discipline in the opening decades of the nineteenth century, and one whose methodological and conceptual orientations remained highly contested. In these early days, the obvious strategic question which the discipline faced was the degree to which it should seek to address the risky question of compatibility with the Genesis account of creation. A wide variety of possibilities were available. At one extreme the Scriptural geologists sought to interpret both scripture and the findings of geology to demonstrate the compatibility of the two; at the other extreme, the mainstream represented by the Geological Society (founded 1807) claimed to interest itself exclusively in studies of an empirical nature, and to leave aside any considerations to do with creation or with providence. In reality, however, even these supposedly austere empiricists had to find a way to reassure their generalist audiences as to the moral respectability of the discipline. Such reassurances were usually offered implicitly, by the choice of language and other general hints.

Also important in the communication effort were the writings produced specifically for the young. It was the duty of society to educate the young in the latest findings of society, but also to safeguard their moral standards. It is thus in the geology handbooks written specifically for children that the concerns about the nature of geology as a discipline can be most clearly sensed, and that the strategies for dealing with this problem take on their most manifest forms. This paper proposes to look at two of the earliest such texts, Maria Hack's *Geological Sketches* (1831) and Mary Robert's *The Progress of Creation* (1837), and to study the distinct narrative strategies used in each of these publications, and to show how they worked to arouse an interest in geology as an empirical study in their readers even while clearly directing them towards more or less explicitly providentialist interpretation of the discipline's findings. It may also prove useful to compare these strategies to those deployed by adult popularisers of the same period, notably Humphry Davy in his *Consolations in Travel* and William Buckland in *Geology and Mineralogy considered in Relation to Natural Theology* (1836).

Session Title: Popular Science For Young People

MECCANO MAGAZINE: BOY'S TOYS AND POPULAR SCIENCE IN INTER-WAR BRITAIN

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Abstract

'Meccano' was a popular model construction-kit for boys, and the same firm also manufactured 'Hornby' model trains. In 1916 the firm began to publish *Meccano Magazine*, at first as little more than an advertising medium. From 1921 the editor was Ellison Hawks, the author of numerous books on science and technology aimed at younger readers, and he used the magazine as a novel way of promoting a broader knowledge of these topics. Although many of the articles dealt with machines that could be modelled, coverage also extended to wider themes in science and technology including astronomy and natural history. The magazine thus built on boys' enthusiasm for models to extend the range of their interests far beyond the most obvious links with the real world of technology.

Session Title: Popular Science For Young People

DINOSAURS DON'T DIE: THE CRYSTAL PALACE MONSTERS IN CHILDREN'S LITERATURE, 1854-2001

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Abstract

Dinosaurs Don't Die, claimed the title of Ann Coates' 1970 children's book, which wondered what would happen if the antediluvian monsters from the Crystal Palace came back to life. In fact, the 'prehistoric animals' had already refused to die: first resurrected by Benjamin Waterhouse Hawkins and Richard Owen in the early 1850s, they had survived the 1936 fire to become Sydenham's only remaining display. The monsters have lived on both on a set of South East London islands but also in many children's books from the mid-nineteenth to the early twenty-first centuries, from elementary instructive works and periodical articles to fictive writing from E. Nesbit, Penelope Lively, and Barbara Kerley and Brian Selznick. Much excellent historical scholarship exists on the creation and original reception of the models, but this longer legacy in books for children remains to be analysed.

The Crystal Palace monsters exist in conversation with the shifting representations of extinct creatures in children's books and exhibitions over the nineteenth and twentieth centuries. As historical objects, increasingly out of step with modern interpretations of the look, heft, and stance of these vanished beings, they are themselves fossilised remains of a past geological age, a fragment of a former world that has survived catastrophe. The importance of giving literary life back to these particular stolid stony forms, then, betrays more than just a generalised authorial attempt at creating appealing animal-like narrators and vivacious adventurers, or an awe for all things dinosaur: they provide a peculiarly immediate re-enactment of the palaeontological process itself, Victorian Britain a pit-stop on the way to prehistory. These children's stories, I show, bring out these issues through an emphasis on time, deploying slippages between centuries, suspended moments, or nocturnal wonderlands to deal with these at once apparently timeless but also precisely 'timed' objects.

Session Title: Popular Science For Young People

THE VALUE OF CURIOSITY AND THE HEROISM OF SCIENTISTS IN *THE CHILDREN'S ENCYCLOPAEDIA*

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Abstract

In the early 20th century, encyclopedias devoted to children and youths became special references concerning science and technology education. First published as *The Children's Encyclopaedia* in Great Britain in 1908, *The Book of Knowledge* became an international best-seller until the fifties, with many editions and translations in Italian, French, Russian, Spanish, Chinese, and Portuguese. This paper analyses how this encyclopedia communicated science and discusses its international circulation. Our analysis focuses on 1) how science is presented, as well its moral e cognitive virtues; 2) the strategies editors used to grab children's curiosity. *The Book of Knowledge*'s articles are vividly written and profusely illustrated. Images are very helpful in explanations, avoiding descriptions that are too abstracts for children. This encyclopedia emphasizes the wonders of science and identifies it with childhood. Both science and children are pointed to as the heir of all past achievements and as the promises for the future. The true science is described as pure, fundamental, and not applied. Accordingly, what moves scientists in their works is curiosity, and they are not expected to worry about practical matters. However, the reasons for cultivating science are mainly its products, whether by honoring the past and present achievements, or whether by betting on its progress. Distinguished scientists are mainly characterized by their moral (perseverance, honesty, courage, selflessness) rather than by their cognitive capacity. Integrated to the purpose of engaging boys and girls in the marvels of science, scientists are described as people who became extraordinary (because of the great contributions they have brought to humanity), but were average children when they began. The paper ends with a discussion with cross-cultural analysis of science popularization, highlighting the meanings of such encyclopedia and its social representation in countries with very low schooling and high illiteracy rates.

Session Title: Popular Science For Young People

TAKING SCIENCE TO PORTUGUESE COUNTRYSIDE, 1909-1913

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Abstract

Short-lived youth magazines made their first appearance in Portugal in the 1850s during t*he Regeneração.* However it was in the last two decades of the nineteenth century that dedicated magazines for children appeared, while books for children and youth written by Portuguese authors came out only at the turn of the twentieth century. This rather late editorial bloom is explained by the low level of literacy of the population: by 1900 only 27% of the population aged 10 or over was literate.

Some of those books taught novel and practical ways of farming. In fact, notwithstanding the progress made around cities in the last quarter of the nineteenth century, Portugal social setting remained rural so that by 1911, 83% of the population lived in the countryside. For most of that population, subsistence farming was the dominant occupation. Hence, to modernize century-old farming methods was as important as to industrialize the country.

This paper aims to discuss how agriculture science was transmitted to children and teenagers in seven books dealing with horticulture, poultry farming, beekeeping, silkworm breeding, dairy farming, orchard culture and fish farming. In this set of books, agricultural science topics are mixed with significant religious, moral and social messages. Themes such as the importance of education and women as successful entrepreneurs appear recurrently. Tellingly, scientism and the rhetoric of progress are adapted to a rural setting.

These books were written by the agricultural engineer João da Motta Prêgo (1859-1931) and published between 1909 and 1913 when the country turned into a Republic (1910). Two of the books were awarded a golden prize while two were approved by the government to be given as gifts to top primary school students. All were republished at least twice.

Session Title: Popular Science For Young People

UNIVERSITY MEETS SCHOOL: PLANCK!, A SCIENCE COMMUNICATION PROJECT BY YOUNG RESEARCHERS

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Abstract

Recent studies about the perception of science by children attending primary school in Italy showed that "science" is a concept characterized by negative feelings such as secrecy, strangeness and danger, and it is also considered a “male subject”. This distorted perception is a sign of a lack of scientific sensitivity in children, probably due to poor and ineffective science communication strategies. In recent years, however, several solutions have been proposed in order to bring children closer to scientific culture, such as interactive museums, science fairs and “open-lab” days. In this context, the University of Padova has created a science magazine for children with innovative features, called PLaNCK!. Its creators and authors are young PhDs and graduates with different backgrounds, supported by a scientific committee. Its purpose is not only to disseminate scientific information, awareness and knowledge among children, but also to educate them to scientific method, open mindedness, and critical sense. University has always stood for intellectual freedom and honesty, and then sets up as a particularly suited subject to introduce children to science. PLaNCK! is also a channel to build a direct relationship between University and primary school, since it helps creating and reinforcing a network between different generations and education levels. Moreover, children are not only the addressees of the magazine, but they have an active part in the project: each issue undergoes an additional review besides the one by the scientific committee, performed by two primary school classes. This approach makes children “authors” in an original way. Finally, PLaNCK! is bilingual: all contents are presented in Italian and in English in each issue, thus providing a tool for integrated learning of English and Science. This is a very up-to-date issue, since new methodologies such as CLIL (Content and Language Integrated Learning) are arising.

Session Title: Children's Science Education Across Time And Places

SCIENTIFIC PROGRESS MIRRORED IN CENTRAL EUROPEAN GEOSCIENCE RELATED YOUTH BOOKS, AND THE ROLE OF WOMEN WRITERS

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Abstract

This study aims to understand how scientific progress had entered the youth book market and which factors may have played a role to transform public knowledge over time. In this paper the development of geoscience-related children and youth books shall be traced, including the diverse fields of mineralogy, archeology and mining. The results are based on an extended literary research of over 150 book titles. During the last 200 years, book genres and themes diversified tremenduously. From the second half of the 19th Century onwards, professionals have been more involved in the book's contents, resulting in a positive effect on the genre. Since the 1860s women began to enter the field of popular writing, however at first only as novelists. Many of the novels adhered to traditional female role models, only peripherally mentioning natural science themes. School books were widely used during the mid- 19th Century, until 1938 when the NS-Government abolished geology as a subject at schools, creating a tremendous gap in the knowledge of planet earth. During the second half of the 19th Century advanced printing possibilities, such as color lithography, oil- and three color prints (from 1895 onwards) were used to produce cheaper, more lively children's books, including picture books influenced by „Art Nouveau" and „Art Deco". During the 1930s to 1960s, caused by economic and intellectual deprivation in Germany, the book-market was meager. After the 1980s the „dinosaur craze" arrived in Germany with dozens of translations from American, French and Czech publishers. During the last decades a positive trend towards more explanatory, easy to understand books, on a variety of science themes is observed. Highly discussed current topics such as climate change, water and food management are addressed in well researched and illustrated children's books. Geoscience-related youth books follow general patterns, reflecting social development and scientific progress.

Session Title: Popular Science For Young People

DISSEMINATING MATHEMATICS TO YOUNG PEOPLE THROUGH THE PRESS, A PERSONAL ACCOUNT

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Abstract

The national Spanish daily journal “El Mundo” set up during the period 1998-2007 an editorial project named “AULA” with the aim of encourage press reading among the Spanish students at secondary school. Thousands of issues of the newspaper where freely delivered from Monday to Friday on demand at public and private high schools along Spain. Once a week, AULA was devoted to scientific information.

Along more than 250 issues spanning more than eight years, a weekly plate about Mathematics was included in AULA. The authorship of the initiative was Lolita Brain, a nickname for the author, a mathematician and teacher interested in spreading mathematical concepts to youths. Among others Lolita Brain’s purposes were the introduction of complex mathematical concepts underlying real life problems, goods or architectural issues focusing on 1) invite young students to read texts about science, 2) provide a chance to students to overcome their scare of the “*Demond of Numbers*”, 3) demonstrate that is possible to communicate mathematical contents without the help of either numbers or algebra, and 4) show that Mathematics are both cultural and historical issues within everybody's reach.

In spite of there were not any survey for the assessment of the impact on the students of neither AULA nor Lolita Brain’s page, in 2004 the approach followed by the author was awarded in the 5th contest “Ciencia en Acción” (the Spanish edition of the European contest “Science on Stage”) institutionally supported by the major Spanish societies for the advance of science (RSEM, RSEM, FECYT).

The master keys of the success of the publication and its methodological aspects will be reveled and discussed along the presentation.

Session Title: **Children's Science Education Across Time And Places**

ASTRONOMY RELATED YOUTH BOOKS DURING THE 19TH AND 20TH CENTURY - A MIRROR OF SCIENTIFIC PROGRESS

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Abstract

Books on astronomy are often written for the general public, ages varying from 10 to 80, who's interest lies in planets, the sun, earth and moon. These books are written for an audience that is fascinated by the star-spangled sky. In this paper we will discuss the development of books that deal with planetology and astronomy until the late 20th century. The results are based on an extended book search and a database. During the last 250 years book genres and themes diversified tremendously, and today the number of publications in German available on the book market surpass several hundred titles, though most are translations from English. The professions and occupations of the authors diversified as well. From the second half of the 19th Century onwards, professional astronomers and writers became more involved. During the second half of the 19th Century more advanced printing possibilities, such as color lithography, and more recently computer generated illustrations were used to produce cheaper, lively books for children and young adults. During the 1930s to 1960s, partly caused by the economic and intellectual deprivation in Germany, books reflecting scientific progress were rarely published. Since the 1950's „space flights" and space travel, as well as astronautics became a favoured topic, triggered by the Russian and American space programs and the landing on the moon. The universe was no more a science fiction story, the universe begun to be a part of serious studies, travels and explanations. In the last 20 years another trend can be observed: more explanatory, easy to understand books on a variety of themes, and current science problems, for example Stephen Hawking's theories, are discussed in well researched and illustrated children books.

Session 33

"THE BEAUTY FALLACY": RELIGIOUS AND SCIENTIFIC AESTHETICS IN POPULAR SCIENCE

Organizers: Arianna Borrelli, Alexandra Grieser (co-org.)

Since the scientific revolution and the enlightenment age, science has come to be the dominant cultural provider of meaning making and accepted knowledge in Western culture. However, as can be seen in mass media and popular depictions of scientific knowledge, this dominance triggers both religious and scientific actors to extend interpretive outreaches and to make claims in responding to the "big questions" in suggestive ways. In the last decades popular and academic science communication increasingly often featured statements and imagery suggesting or explicitly referring to religious themes: Steven Weinberg's "first three minutes", string theory's "multiverse landscape", nanotechnology's "Grey goo" scenario. Such themes are often presented with a tongue-in-cheeck attitude or put down as "mere metaphors", but is this all there is to them?

While in the history of science the relationship between religious and science has recently been treated as a more complex and diverse topic than before, analytical approaches which go beyond the the quest of "compatibility" or "exclusion" are rare. Hence, in this panel, we will not reproduce ideological claims or normative debates about the (in)compatibility of religion and science. Rather, we are interested to investigate the the role of aesthetics and beauty in science communication both in popularization and within academic discourse. We will look from the perspective of the natural sciences as well as from the cultural study perspective, seeing both "religion" and "science" as discursive cultural practices and institutions which are mutually entangled in manifold yet different ways. We invite case studies as well as theoretical reflections, and we appreciate interdisciplinary analytical approaches.

Session Title: "The Beauty Fallacy" - Religious And Scientific Aesthetics In Popular Science

BEAUTY, UGLINESS AND BELIEF IN THEORETICAL PRACTICES OF HIGH ENERGY PHYSICS

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Abstract

The rise of theoretical particle physics in the late 1950s was accompanied by an increased significance of symmetries as privileged epistemic guidelines to understand the order behind the apparent chaos of particle phenomena. In this context, aesthetics increasingly often appeared in arguments for or against theories. The physicists Chen Nin Yang wrote in his 1957 Nobel lecture that "[w]hen one pauses to consider the elegance and the beautiful perfection of the mathematical reasoning involved [in symmetry arguments] and contrast it with the complex and far-reaching physical consequences, a deep sense of respect for the power of the symmetry laws never fails to develop." In the 1970s, while the highly symmetric "Standard Model" was becoming established as a very successful theory of particle phenomena, physicists were already looking for a more beautiful alternative in the form of a "Grand Unified Theory" uniting all symmetries in one, of a "supersymmetry" or of highly symmetrical "superstrings". This search lacked any empirical motivation, but was - and still is - driven by arguments which physicists refer to as having "aesthetic" character: some features of the Standard Model are presented as aesthetically unacceptable, ugly, and as such "unnatural". Such claims are not mere rhetoric devices, but express a deeply rooted belief shared by the large majority of high-energy theorists. As the theorist Mikhail Shifman put it. „the criterion of naturalness is aesthetic, or, if you wish, philosophic. If you do not like it you can ignore it. Most people like it“.

Session Title: "The Beauty Fallacy" - Religious And Scientific Aesthetics In Popular Science

BEAUTIFUL DESTRUCTION – THE AESTHETICS OF APOCALYPSE IN HANS DOMINIK'S EARLY SCIENCE FICTION

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Abstract

Though not very well remembered today, Hans Dominik was one of the most prolific – and successful – German authors of trivial literature in the early 20th century. According to estimates millions of copies of his books have been sold, making Dominik one of the most important figures when it comes to popularisation of science in early 20th century Germany. Though the term "Science Fiction" was deemed somewhat later, his works – like those of many others – can still be seen as early examples of the genre. Being a trained engineer and a PR-agent by profession, Dominik drew heavily on the scientific topics that made the headlines in those days and yet managed to create something new out of them. One of the methods he made use of was to magnify the relevance of scientific enterprises and depict the consequences of science – or scientific misconduct, rather – as the beginning of catastrophe or even apocalypse. Likewise, Dominik often introduced (future and thus "better") science as the only means to save the world. Thus Dominik was able to compose images of the use of atomic-energy or nuclear weapons – to name but a few – and there either creative or destructive power, decades before such devices were technically feasible.

The talk will introduce the actual scientific topics Dominik made use of and will then show how the aesthetic changes he applied to them by making use of quasi-religious motifs turned them into fantastic literature.

Session Title: "The Beauty Fallacy" - Religious And Scientific Aesthetics In Popular Science

THE GOD PARTICLE AND THE QUANTUM APOCALYPSE – COMPREHENSIVE AESTHETICS FOR THE INCOMPREHENSIBLE

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Abstract

When CERN was founded in the aftermath of World War, II atomic research was strongly associated with visions of nuclear Armageddon. Today, with few exceptions, the beneficence of such research is unquestioned. Scientists are described to be on the verge of discovering sub-atomic particles responsible for the creation of the universe. A Great Revelation is imminent which, it is foretold, will release us from our mortal material human limits.

This paper will trace the apocalyptic aesthetics of particle physics from the genesis of the Big Bang Theory with Msgr. Fr. Georges Lemaître to its contemporary manifestations in speculative images of inaccessible and incomprehensible foundational events. The figure of Leon Lederman's “God Particle“ appears in the graceful graphic lines and curves and in photographs of spectacular scientific installations, “cathedrals of science”.

Paul Dirac said "The new theories...cannot even be explained adequately in words at all." Vilém Flusser would warn us, however, that the fact that words appear inadequate does not mean that, through using other heuristics, we liberate ourselves from the traditions of Humanist discourse. Underlying the imagery used to render HEP research comprehensible and attractive to the public-at-large are rational arguments honed over centuries of human reckoning with the unknowable.

Session Title: "The Beauty Fallacy" - Religious And Scientific Aesthetics In Popular Science

"WE'RE BEAUTIFUL, AND WE'RE ONE" - AESTHETICS AS A UNIFYING CONCEPT WITHIN THE "RELIGION AND SCIENCE-NEXUS"

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Abstract

Be it in public discourse or in academic analysis, talk about the relationship between religion and science often treats both spheres as self-contained entities which relate to each other either in conflicting or compatible ways. Historical case studies have shown that empirical reality is more complicated than that, and that we need to ground our understanding of this complex interaction in larger theories of knowledge, culture and meaning making. In a first step, the paper will sort out what we actually compare when relating "science" and "religion" to each other, what data we refer to, and what ideological luggage we encounter in the models and metaphors we use. In a second step, it will be shown that references to beauty and aesthetic qualities made by scholars are central to how religion and science interact since romanticism, and that there is more to aesthetic devices in popular science than fostering appreciation and enthusiasm for a scientific world view, especially if we take into account aesthetic as scientific argument, and the effects of aesthetic formats of popular science.

Session 34

IMPERIAL GEOGRAPHIES, COLONIAL OBSERVATORIES, AND THE CIRCULATION OF KNOWLEDGE

Organizer: Pedro M. P. Raposo

Observatories occupy a prominent place in the history of science. They have constituted privileged focal points in the development of fields such as astronomy, astrophysics and geophysics. The appropriation of the word “observatory” beyond its original scientific meaning (think of observatories for policy, health, trade, crime, etc.) hints at how the notion of “observatory” became intimately associated with ideas of effective surveillance, administrative efficacy, and collective security. In short, with the very idea of modernity.

By developing tools and techniques to grapple with time, weather, and territory, observatories helped to shape the modern state. The knowledge they embodied was pivotal in the development of administration. Concomitantly, it informed and spurred many other techno-scientific pursuits. Observatories contributed to the emergence of new scientific discourses, audiences and actors, by hosting popularization activities, and by fostering new communities of professional and amateur practitioners. Patrons, heads of state and civic groups often sponsored observatories as symbols of their might, wealth, and/or commitment to science and progress.

European colonial expansion would have hardly been possible without observatories. Besides assisting navigation, metropolitan observatories supported colonial surveys, promoted the mapping of previously uncharted skies, and set the guidelines for the study of colonial climates. Colonial observatories were often founded as a consequence of these undertakings. In other cases, they emerged together with aspirations and agendas that equated local autonomy with scientific progress. All of these settlements were involved in complex networks that shaped the geographies of empire, as they nurtured the circulation of practitioners, instruments, ideas and techniques over vast geographical areas.

This session brings together research on colonial observatories in the Dutch, French, and Portuguese empires. We intend to discuss the role of observatories with regard to imperial circuits, perceptions of empire and colonialism, the interaction between colonizers and native populations, and the broader development of techno-scientific cultures in colonial context. We are ultimately concerned with the historical role and meaning of observatories in terms of the circulation and communication of knowledge, as it happened in the complex geographies of empire.

Session 34: Imperial geographies, colonial observatories, and the circulation of knowledge

RELIGION AND SCIENCE IN FRENCH COLONIAL EXPANSION: THE JESUIT OBSERVATORY OF AMBOHIDEMPONA, (MADAGASCAR) 1888-1939

Heloise Finch-Boyer

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The Jesuit Observatory at Ambohidempona, Madagascar (1888-1967) was the first French observatory in the Southern Hemisphere. Father Elie Colin, the first director of the Observatory, trained at Stonyhurst with Father Stephen Perry and at Montsouris in Paris, before travelling to Madagascar in 1887. The surveying work of Colin and his colleagues was instrumental to the French colonisation of Madagascar in 1896, and work done in seismology, astronomy and meteorology was read by a large number of scientists at the Meteorology centre in Paris, Strasburg centre and further afield.

While the Observatory still exists as part of the University of Madagascar, there has been little historical analysis of its work. This paper analyses the link between science and religion from the implantation of the observatory, through the 1895 French conquest of Madagascar and up to the dawn of the Second World War. My presentation discusses how the Jesuit Observatory in Madagscar was set up (including the provenance of instruments donated), in the context of enduring links between religion and colonisation in France before the 1905 separation of church and state. Secondly I examine the nature of the Jesuits' scientific and survey work in Madagascar at the dawn of French colonisation of the island. I will address the key question of who used these instruments: only a handful of Jesuits, as some researchers have claimed, or also the Malagasy research assistants at the Observatory? What was the circulation of knowledge and techniques between French and Malagasy? Finally, the paper will address how knowledge created in Madagascar circulated and among scientists in the southern hemisphere (Mauritius, La Réunion) and the northern hemisphere (USA, France, China and Indochina).

Session 34: Imperial geographies, colonial observatories, and the circulation of knowledge

"CALIGULA IN ANGOLA" SEEKING A NEW OBSERVATORY: NORTON DE MATOS'S SCIENTIFIC COLONIALISM AND THE JOÃO CAPELO OBSERVATORY IN LUANDA

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José Maria Norton de Matos (1867-1955), a military surveyor by training, governed Angola between 1912 and 1915, and for a second time from 1921 through 1924. Some hailed Norton de Matos as an enlightened purveyor of rational colonialism. Others regarded him essentially as a ruthless despot; such was the case of Cunha Leal (1888-1970), also a military engineer, who authored a book criticising Norton de Matos's colonial policies, suggestively entitled "Caligula in Angola."

Norton de Matos provides an interesting case of a colonial ruler in whose action a penchant for autocracy and spendthrift exhibitionism combined with a firm belief in science as a driving force for colonial development. In fact, he promoted several undertakings aiming to boost the sciences in Angola, especially during his second tenure as governor. One of these undertakings was the renewal of the João Capelo Observatory (JCO) in Luanda, a settlement committed to meteorology and timekeeping, founded in 1879.

In this paper I shall place the renewal of the JCO into the wider picture of Norton de Matos's colonial ideology and policies, and discuss its relations with successive plans fostered in Lisbon towards the constitution of an imperial observatory network. I will also analyse it in terms of the circulation of scientific instruments and practices in the Portuguese colonial empire, during the first decades of the twentieth century.

Session: Imperial geographies, colonial observatories, and the circulation of knowledge

“THEY ALREADY KNEW IT!”: FRENCH COLONIAL ASTRONOMY ON THE BORDER OF THE EMPIRE IN 1862

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Abstract

Before being permanently installed in 1885 atop of the Bouzaréah, mountain overlooking Algiers, the French colonial observatory in Algeria was a vagabond. Several places were so designated since the invasion in 1830… During one of these changes (late 1861 - early 1862), Charles Bulard, director at the time, undertook a tour of the country under conquest, through "the most advanced main points in the extreme south of Algeria", to observe various astronomical phenomena, including the solar eclipse of December 31, 1861, and an occultation of Venus by the Moon on 1 February 1862. He had with him a brand new instrument, the reflecting telescope with parabolic silvered glass mirror invented by Foucault. I want to show in this paper how this astronomical journey contributed to define the physical and cultural boundaries of the Empire, and how astronomical practice, at that time, was expected to accommodate and support the colonial policy of France in Algeria .

Session 34: Imperial geographies, colonial observatories, and the circulation of knowledge

ASTRONOMICAL OBSERVATORIES IN A DUTCH COLONIAL CONTEXT

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In the history of colonialism, the Dutch approach differs from those of other European countries. In the 17th and 18th century Dutch colonies, sovereign authority was not exercised by – or in the name of – the government of the Dutch Republic, but by the board of the Dutch East and West Indian Companies: the *Verenigde Oostindische Compagnie* (VOC) and the *Geoctrooieerde Westindische Compagnie* (GWC), respectively. As the main goal of these companies was foremost the achievement of financial profit, rather than the building of a colony as a satellite of the European fatherland, this implied that the founding of astronomical observatories in the Dutch colonies was – more than anywhere else – a question of private initiative. For a large part this situation remained so, even in the later period when the government of the in 1815 newly founded Dutch monarchy had taken over the sovereignty of the former VOC.

In my presentation I will discuss the founding, function, patronage and main achievements of the three most prominent Dutch colonial observatories: the Marggrafe Observatory (1638-1644) in Recife (Dutch Colonial Brazil); the Mohr Observatory (1768-1775) in Batavia (Colonial Dutch East Indies) and the Bosscha Observatory (1923-present) in Bandung (Dutch East Indies/Indonesia). What was their role in the Dutch Colonial context? What reasons drove the various individuals to erect these institutions? After which examples were they modelled and how were they funded? What was their place in the world-wide circulation of astronomical and meteorological knowledge and practices? These questions are addressed in my contribution to this session on colonial observatories for the 6th meeting of the European Society for the History of Science.

Session 35

THE CURE AND CULTURE OF MINDS: EARLY MODERN PEDAGOGIES OF SCIENCE AND MEDICINE

Organizers: **Sorana Corneanu & Charles T. Wolfe**

The early modern period in Europe was a time of growing interest in the idea of the cure and care of the soul in parallel with or as complementary to medical concerns with the cure and care of the body. Such phrases as the “medicine” and the “culture” of the mind became widely circulated indicators of this interest, which operated across disciplines. Indeed, the early modern programme for managing passions, errors of reasoning but also mental disturbances (or pathologies) was a diverse set of theoretical and practical projects, embedded in various medical, philosophical, pedagogical and theological worlds. The historical and conceptual shapes of the early modern medicine and culture of the mind are starting to be traced in current scholarship from a variety a vantage points. In this session we would like to address its relation with, on the one hand, the investigation of particulars (*historiae*) characteristic of an empirical, exploratory mindset and, on the other, the pedagogical aspects of the communal circulation of knowledge.

Historiae are involved in a twofold way in the medicine and culture of minds: a) as diagnosing tools, they serve the assessment of given mental and corporeal conditions, as well as the establishment of the relative weight of diversity/particularity and generality of features; and b) as forms of regimen, whether corporeal-medical, moral-philosophical or natural-experimental, they play a role in the very curative process. The latter includes a variety of forms, ranging from the reforming to the manipulative, and covering the whole social spectrum from the individual to the widely collective. On a small scale, the medicine and culture of minds takes the form of interplays between individual and small-community pedagogical programmes; but they can also be extended into large-scale programmes of educational reform. The papers in this session will investigate these and related aspects of the problem as they bear on early modern educational, experimental-philosophical, astrological and medical thought.

Session title: The Cure and Culture of Minds: Early Modern Pedagogies of Science and Medicine

HOROSCOPIC *HISTORIAE* AND THE REGIMEN OF HUMAN SPIRITS

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Abstract

Astrology has often been advanced as a singularly old and powerful cultural resource for naturalising the self and its challenges. Focusing on the relation between the stars and human embodiment, the art provided a unified predictive and diagnostic framework for organising individual and communal welfare. Nevertheless, historians should be careful in approaching astrology as a pre-scientific version of modern technologies seeking to maximise human material comfort. Much of the astrological tradition in fact presented itself as geared towards the soul rather than the body, and therefore makes more sense within the broader tradition of spiritual exercises and medicine of the mind.

This perspective puts a premium on the way in which astrology was called in to analyse, diagnose, and treat the passions and disturbances of the mind. As was the case in other practices seeking to address possession of the self, early modern astrology easily bridged theology, natural philosophy, and medicine while increasingly redefining itself as an art of representation and control.

This shift often privileged individual natal charts as its proper diagnostic tools, and spawned a rich tradition of the circulation and communication of horoscope collections in the sixteenth and seventeenth centuries. These collections of individual *historiae* detailed the celestial intricacies of human *mirabilia*, including disturbances of the mind like melancholy or phrensy. Endowed with rhetorical and empirical functions, they increasingly guided and structured astrological attempts at regimenting the human spirit.

By drawing on a number of these *historiae*, this paper will seek to address two main questions: (1) How was the communication of astrological *historiae* supposed to function within the broader framework of the medicine of the mind? (2) How did early modern astrologers understand the soteriological and anthropological challenge of celestial disturbances?

Session title: The Cure and Culture of Minds: Early Modern Pedagogies of Science and Medicine

HISTORIAE OF THE SOUL: PHYSIOLOGY AND RHETORIC IN EARLY MODERN MEDICINE OF THE MIND

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Abstract

The self-identification of early modern texts or sections of texts as belonging to the category of the "medicine of the mind" is starting to be recognized in current historiographic appraisals of early modern inquiries into the soul's relation to the body, whether medically, morally or theologically inclined. Here we want to consider the more markedly medical quarters of this early modern literature, and address the role played by the *historiae* of the soul they narrate, as well as the relation of the latter with the rhetorical and pedagogical role invested in these texts. There is a twofold relevance of *historia* as far as the soul is concerned. First, there is in this period an increasingly physiological approach to the description of the workings of the soul, which takes the form of natural histories of embodied minds. Second, the diagnostics and therapeutics of mental disturbances (often covering a variety of phenomena, ranging from the moral to the pathological) often rely on exemplary stories which describe symptoms and cures by means of eloquent narrative. These stories have a double function: they are epistemic tools on a par with the medical case studies; and they are invested with a therapeutic role owing to their persuasive force. The counterpart of this rhetorical function of stories is the rhetorical-cum-pedagogical intention of the mental-medicinal texts themselves, largely derived from the very particularistic nature of the genre of *historia* itself, as well as from the types of audiences they explicitly or implicitly address. In this paper, we look at these issues with reference to several such texts, which we take as representative of the evolution of the early modern medicine of the mind, from the late sixteenth to the early eighteenth centuries.

Session Title: The Cure And Culture Of Minds: Early Modern Pedagogies Of Science And Medicine

BOOKS AS A CURE FOR THE MIND: ROBERT HOOKE'S DESIGN FOR AN EXTERNAL MEMORY OF THE SCIENTIFIC COMMUNITY

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Abstract

In the Preface to *Micrographia* (1665) Robert Hooke presents his own "universal cure of the mind", which consists in "[t]he addition of such artificial instruments and methods [by which] there may be, in some manner, a reparation made for the mischiefs, and imperfection, mankind has drawn upon it self." In this presentation I will discuss the role the compilation of natural histories plays in Hooke's scientific methodology and the link it has with his cure of the mind. I will show how a natural history for Hooke is not only a storage of information, but can in several ways function as a cure for the frailties of the human faculties. This will be illustrated by two examples, on the one hand Hooke's *Micrographia*, on the other his contribution to Sprat's *History of the Royal Society of London* (1667), in which he puts forward very concrete proposals "for the better making a history of the weather." I will show how Hooke designs specific textual and visual forms that can serve as the basis for the development of an externalised and collective memory for the scientific community. On the one hand, these forms make possible the *condensation* of the information obtained from different observations into one format. On the other hand, they have the function of *disciplining* potential observers. The two functions are interrelated: it is only because the observers are *disciplined* and provided with a format in which they must imbed their observations that different observations made by several observers can be *condensed*. Making the link with his cure of the mind will allow me to show how books, the external memory of the scientific community, can "cure the mind" of the individual.

Session Title: The Cure And Culture Of Minds: Early Modern Pedagogies Of Science And Medicine

BOOKS AS A CURE FOR THE MIND: ROBERT HOOKE'S DESIGN FOR AN EXTERNAL MEMORY OF THE SCIENTIFIC COMMUNITY

Pieter Present[a]

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Abstract

In the Preface to *Micrographia* (1665) Robert Hooke presents his own "universal cure of the mind", which consists in "[t]he addition of such artificial instruments and methods [by which] there may be, in some manner, a reparation made for the mischiefs, and imperfection, mankind has drawn upon it self." In this presentation I will discuss the role the compilation of natural histories plays in Hooke's scientific methodology and the link it has with his cure of the mind. I will show how a natural history for Hooke is not only a storage of information, but can in several ways function as a cure for the frailties of the human faculties. This will be illustrated by two examples, on the one hand Hooke's *Micrographia*, on the other his contribution to Sprat's *History of the Royal Society of London* (1667), in which he puts forward very concrete proposals "for the better making a history of the weather." I will show how Hooke designs specific textual and visual forms that can serve as the basis for the development of an externalised and collective memory for the scientific community. On the one hand, these forms make possible the *condensation* of the information obtained from different observations into one format. On the other hand, they have the function of *disciplining* potential observers. The two functions are interrelated: it is only because the observers are *disciplined* and provided with a format in which they must imbed their observations that different observations made by several observers can be *condensed*. Making the link with his cure of the mind will allow me to show how books, the external memory of the scientific community, can "cure the mind" of the individual.

Session Title: The Cure And Culture Of Minds: Early Modern Pedagogies Of Science And Medicine

COMMUNICATING SCIENCE *AD MAIOREM DEI GLORIAM:* COMENIUS' CIRCULATION OF 'UNIVERSAL CULTURE' IN THE EUROPEAN PERIPHERY

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Abstract

John Amos Comenius (1592–1670) was an important seventeenth-century communicator and educational reformer of the sciences. Originally from Moravia, he was exiled to Poland as a result of the Counter-Reformation, and he travelled the whole of protestant Europe. He became an international figure, creating new educational institutions in the European periphery, and inspiring the founding of early scientific societies. I will argue that Comenius' view of the sciences realized a new synthesis of humanism and religion, in what can be called a Protestant response to the dominant Jesuit educational ideology. For Comenius, the European periphery functioned as a laboratory for his educational reforms. In an inaugural lecture in Hungary, drawing on the tradition of the cultivation of the mind, he elaborated on the books, schools and teachers needed for communicating science to the next generations. In particular, Comenius revalued the concepts of *'cultura'*, *'humanitas'* and *'ingenium'*, giving them a new meaning in the service of his educational reformation. Indeed, the Jesuits had harnessed the new concept of 'culture' for their educational program and institutions (see my proposal for the STEP conference). In contrast, Comenius envisioned a 'universal culture', which would be the result of teaching and communicating the sciences. Paradoxically, Comenius also imagined the possibility of different cultures, that is, people cultured according to different values, norms and practices. The tensions in Comenius' notion of culture arise from the particularly polemical environment in which it was developed, full of intellectual and religious strife. From an educational perspective, the circulation of the sciences could be presented as liberation from barbarity, error and sin. From a political perspective, however, the central aim was the domination of the hearts and minds of the people by different religious factions.

Session 36

HISTORY OF SCIENCE FOR SCIENCE EDUCATION

Organizer: Peter Heering

Science education is one of the activities that are closely related to science communication. Yet, different to the communication between scientists or scientific communities, science education addresses the communication of scientific concepts to learners. Whilst until the end of the 20th century, science education focused on transferring knowledge from the knowing teacher to the learning student, the aim of science education in the 21st century is significantly different: Science education aims at enabling novices to construct their own understanding of science and about science. In this respect, the history of science does not simply provide tools for better communicating scientific ideas to novices in a field. History of science also enables the communication and illustration of aspects from the nature of science, thus – among other aspects – helping students (as well as a lay audience in non-formal learning situations) to understand science as a process and as a cultural activity.

The papers in this session either discuss historical studies that were carried out with the explicit intention to develop materials for educational purposes, or discuss educational materials that are used in the history of science.

Session Title: History Of Science For Science Education

HISTORICAL ROOTS OF ENERGY EDUCATIONAL DEBATES

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Abstract

Today “energy” is one of the most widespread terms in popular and scientific use. Both enthusiasts and opponents of contemporary Western civilization recognize its foundational role (Ostwald; Heidegger). Eastern philosophies of Nature have terms that are related to it (Needham). “Energy” issues dominate social, political, technological, military discussions and events. However it is not at all clear if its various meanings are acceptable aspects of its polysemic nature or the result of deep confusion. This is particularly important in science education, where these issues have been debated for a long while without generating a shared view. Is there a way to clarify the field? History can provide some help. Most of the debated topics, often controversial, have historical roots: energy as substance or function (Meyerson-Cassirer); energy as divided in a positional (potential) and kinetic form (Helmholtz-Clausius); energy as the product of an intensive and an extensive factor (Rankine); work (effects in space) as the unity of measurement of all the phenomena of nature (Leibniz, L.Carnot); various kinds of potentials (Weber, Clausius, Duhem); conversion with a constant coefficient (Mayer-Joule, Rowland); conservation of energy but degradation of its quality (Clausius-W.Thomson); energy as a time invariant (Noether); impossibility of a final expression (Planck); superposition of the various forms (Planck); local and global conservation (Poynting, Hertz); heuristic power in determining new phenomena (Bohr-Pauli-Fermi); equilibrium and non-equilibrium approaches (Prigogine). Thus specific educational approaches reveal implicit acceptance of a specific historic research program. Revisiting critically these programs and transforming energy assumptions from implicit to explicit could be of great educational benefit.

Session Title: History Of Science For Science Education

A CONTRIBUTION FROM THE HISTORY OF CHEMISTRY TO THE UNDERSTANDING OF THE NATURE OF SCIENCE IN SCIENCE TEACHER EDUCATION

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Abstract

Science teaching and science teacher education involves knowing something about science itself, how scientific knowledge has been obtained, how reliable it therefore is, what its limitations are, how far we can therefore rely on it, its changing methods and also knowing something about the interface between scientific knowledge and the wider society. In brief, science teaching and science teacher education also means knowing something about the nature of science.

This communication intends to illustrate how the history of chemistry can contribute to the understanding of the nature of science in science teacher education by proposing different historical episodes to deal with certain aspects of the nature of science concerning scientific research, explanations, creativity, the role of the scientific community and the interplay between science and society.

Session Title: History Of Science For Science Education

THE SPRINGER INTERNATIONAL HANDBOOK OF RESEARCH IN HISTORY, PHILOSOPHY AND SCIENCE TEACHING

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Abstract

This work is an international endeavour with 75 chapters being written by 125 authors from 30 countries. The handbook groups extant research into four sections:

- Pedagogical Studies
- Theoretical Studies
- Regional Studies
- Biographical Studies

The Pedagogical section was straightforward. Since Mach's time, educators have looked to history and philosophy in order to improve and make more interesting and engaging the classroom teaching of science and mathematics. For over a century these endeavours have been pursued in Physics, Chemistry, Biology, Mathematics, and more recently in the Earth Sciences, Astronomy, Cosmology and Ecology.

Many topics included in the theoretical section were straightforward; they were obvious choices. Science teachers, curriculum writers, examiners and textbook authors clearly have to address larger philosophical matters about, for example: religion, multiculturalism, indigenous knowledge systems, nature of science, scientific method and inquiry, argumentation, constructivism, evolution education, postmodernism, scientific literacy, and the relation of science to personal and cultural worldviews.

HPS&ST issues and associated research have occupied teachers and educators in many countries. By detailing for selected countries and regions these debates and research something can be gleaned about the international extent of concern about the place of history and philosophy, or nature of science, in science teaching; and the particular ways in which teachers, academics and educational administrators in different countries have responded to this concern.

The five chapters in biographical section – on Mach, Dewey, Schwab, Westaway and Holmyard – deal with the foundation figures of HPS&ST scholarship. Chapters explicate the view of HPS held by their subjects and how their views connected to then extant HPS positions and indicate how this HPS understanding had connection with educational practice.

Session Title: History Of Science For Science Education

INVESTIGATING THE HISTORICAL DEVELOPMENT OF THE CONCEPT OF MATTER FROM ANCIENT ATOMISM TO QUANTUM MECHANICS

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Abstract

It has been argued that the role of the history of Atomism should be a basic component in all science curricula. Recent discussions on Atomism and its history in school textbooks and curricula suggest that science educators should consider that the History of Atomism and its position in the History of Science is still a matter of debate. Alan Chalmers published a book in which he surveys the history of atomism from Democritus to the twentieth century, examining the varying contexts in which science has been practiced. In this book, Chalmers sees modern atomic theory as the recent legacy of experimental science as it emerged in the 17th century rather than in the tradition of natural philosophy dating back to Democritus and extending to seventeenth-century mechanical philosophy and beyond.

This paper investigates the historical continuity in the development of the concept of matter and the controversies surrounding it originating in antiquity when natural philosophers first speculated about the constitution of the physical world. Starting with the ancient Greek atomists who attributed all physical phenomena to atoms and their motion in the void and Aristotle for whom matter is linked by definition to a process of change, the paper examines the contributions of thinkers like Descartes, Newton and Maxwell and shows how Quantum Mechanics by postulating the coexistence of the particle and the wave descriptions of matter pushes scientific thinking to a different and renewed conception of the physical world.

Session Title: History Of Science For Science Education

DEVELOPING STORIES FROM THE HISTORY OF SCIENCE FOR THE SCIENCE CLASSROOM

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Abstract

There has been a variety of approaches to implement aspects from the history of science in various educational settings; several of them have been presented at the previous ESHS meeting. The approach that will be presented in this paper can be described as a modification of the story approach that has recently been advocated by scholars such Allchin, Clough, and Klassen. Their approach that uses stories from the history of science has been slightly expanded in a project funded by the EC:

S@TM aimed at developing stories that are to be narrated in the classroom, thus the teacher is supposed to adapt the story according to her or his needs and to tell this story orally. With this approach, we aimed at enabling the teacher to address aspects that are relevant in the respective teaching situation as well as to have a closer communication with the students. The stories that were developed for this purpose are based on the respective historical analysis and address mainly topics from the fields of energy, nutrition, and atomism.

In 2013, the materials were prepared and the first teacher trainings were realised, focusing mainly on the art of storytelling. In doing so, the training was carried out in collaboration of a historian of science and a professional narrator. In the presentation, the approach will be sketched and some of the materials will be discussed. In particular, the development of the stories related to the concept of energy will be discussed, thus giving some insights in the criteria that were used in this process. Additionally, the evaluation of the first teacher trainings will be communicated.

Session Title: History Of Science For Science Education

ALGEBRA AND GEOMETRY THROUGH THE HISTORY OF THE QUADRATIC EQUATION

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Abstract

Implicit and explicit contributions of the history of mathematics can provide teachers with an enrichment of their teaching. Knowledge of the origin and evolution of ideas and mathematical concepts is useful in improving student learning.

The study of polynomials and equations associated with them, which has evolved so much over time, gives us a history of the geometric construction of the solution of the quadratic equation with instructive and suggestive passages for students of secondary or university degree.

In this communication we show an activity implemented in the classroom, in recent years, linking algebra and geometry through the history of the quadratic equation. In this activity two geometric constructions of the solution of the seventeenth century quadratic equation based on Euclidean propositions are discussed. These analyses provide students with a deeper and more fertile view of mathematics.

Session Title: History Of Science For Science Education

ENGINEERING EDUCATION IN THE NINETEENTH CENTURY: THE COLLECTIONS AT THE BARCELONA SCHOOL OF INDUSTRIAL ENGINEERING

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Abstract

The Higher Technical School of Industrial Engineering of Barcelona (ETSEIB) preserves a relevant collection of instruments, models, and machines constituted during its more than 160 years of history. Some of the pieces belong to previous technical schools that were merged to form the engineering centre. Since 2000 our group has focused on studying and cataloguing the collection of scientific instruments, models and machines of the Higher School of Industrial Engineering of Barcelona (ETSEIB). Our aim is to create the Museu de l'Enginyeria de Catalunya (Museum of the Engineering in Catalonia), as a way to offer a vision of the role of engineering in Catalonia and Spain through the collection of ETSEIB. This was the subject of a project of Valentines-Álvarez in 2002. However, this seems illusory at present. Since 2010, we have extended our research to the other school of industrial engineering in Barcelona (currently EUETIB). The study has been carried on by Carlos Acosta. The aim is to offer a global vision of the heritage of industrial engineering education in Barcelona.

Session Title: History Of Science For Science Education

THE DIALOGUE ON ARITHMETICS IN THE *ARITHMÉTICA PRÁCTICA Y SPECULATIVA* BY JUAN PÉREZ DE MOYA

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Abstract

In the last ten years, the majority of European countries have revised their curricula adopting a competency-based approach to respond to the needs of a wide range of learners. However, a study made in 2011 by the European Commission, reveals that central authorities are generally falling short on providing guidance to teachers for implementing the revised curricula.

In the case of Mathematics, its History could be a useful resource to guide teachers to develop a more competency-based curriculum. For that reason, the History of Mathematics can be mainly used in two ways: on the one hand, as a didactic resource to help students to better understand some mathematical concepts, and, on the other, as an integral educational resource to provide students with a more realistic conception of Mathematics than they often have at the end of secondary school. In both ways, the use of History of Mathematics could be effective in improving students' learning of Mathematics and also students' attitudes toward Mathematics.

This communication intends to exemplify the way the History of Mathematics can be used to teach Mathematics using a competency-based approach, by analyzing a historical text, the 9th book of the *Arithmética Práctica y Speculativa* by Juan Pérez de Moya. This was the most popular mathematical work written in the Iberian Peninsula in the XVI century and reached 30 editions. The 9th book of the *Arithmética* is written as a dialogue between students. It shows different points of view about the usefulness of Mathematics and the reasons for the importance of acquiring knowledge out of them. In this talk we will analyze both the reflections and pieces of advice of the characters and their opinions in relation with the importance of Mathematics, and some problems which have become part of the collective imaginary.

Session 37

CIRCULATION AND COMMUNICATION OF THE CHEMICAL KNOWLEDGE IN THE GREEK-SPEAKING COMMUNITIES FROM ANTIQUITY TO THE 17TH CENTURY

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Chemistry probably may not have the nobility of the origins of other major sciences since it is firmly fixed in the practices of craftsmen. Thus, from its emergence in the Graeco-Egyptian world, the distinction between theorists and craftsmen had no meaning at all. In the chemistry, work and theory were remaining inseparable because the aim was always the transformation of bodies or the production of medicines or consumer goods. And people, including political powers, were expecting much of chemistry for medical and economic interests and for the natural philosophy knowledge as well.

The Greek-speaking chemistry was the object of a quite limited interest by historians of science. And yet this chemistry did not cease diffusing from the 1st century B.C. to the 17th century through many ways as it is obvious with the recently discovered manuscripts: through craftsmen, copyists, scholars, clergymen, in the Byzantine world and Ottoman Empire as well, and in interactions with the Arabian and Western thoughts and crafts. Its diffusion implicated various categories of people and was carried out under various constraints. Its communication was realized in both spellingly-free demotic Greek and scholarly ancient Greek.

In this Symposium, we wish to question the modes and networks of the communication of the Greek-speaking chemistry which was at the same time, from Antiquity to the 17th century, on the fringe of the development of the science thoughts and in the midst of the business of the world, the medical, economic and philosophical life of societies, transgressing the borders between art and science.

Session Title: Circulation And Communication Of The Chemical Knowledge In The Greek-Speaking Communities From Antiquity To The 17th Century

DESIGN AND DEVELOPMENT OF EDUCATIONAL ACTIVITIES BASED ON THE HISTORY OF ALCHEMY

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Abstract

This paper consists of two parts: In the first part a short account of the role of History of Science in Science Teaching is given underlying the merits of the historical approach in the science classroom. In the second part, the paper reports on the design and development of a series of teaching activities based on the History of Alchemy (4th-17th centuries) as it is reconstructed through the collections of primary and secondary literature in the data bases of the project DACALBO (:Digital archive concerning alchemy in Byzantium and in Greek-speaking communities of the Ottoman Empire) implemented by the research consortium “History, Philosophy and Didactics of Science and Technology” (www.hpdst.gr).

Two sets of teaching activities have been designed and developed: 1) Activities aiming in the training of secondary teachers of Chemical and Life Sciences in using original (alchemical) texts for the reconstruction of apparatuses in the school laboratory and 2) Activities aiming in raising awareness on issues of cultural heritage for the wider public.

Namely, activities supported by innovative interactive charts and timelines, activities exploring the relation between the Greek, Arabic and European alchemical traditions, and activities highlighting the technical applications of Alchemy (eg. pigments), the relation of alchemy to medicine and the presence of alchemy in poetry, literature and myths.

Collateral topical activities have been also developed such as the description of the materials used for writing, the laboratories of copying (Scriptoria), the coloring of clothes and the use of plants during the Medieval and Modern period.

Session Title: Circulation And Communication Of The Chemical Knowledge In The Greek-Speaking Communities From Antiquity To The 17th Century

ATHANASIUS RHETOR'S CHEMISTRY IN THE MIDST OF SEVERAL WORLDS

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Abstract

Athanasius Rhetor, Greek priest educated in a Jesuit school before owing allegiance to the pope, was born in Cyprus in 1571 but lived in Constantinople up to the 1610's. Then he moved to Roma and then to Paris whose intellectual life he contributed to and where he died in March 1663. Sent by his French patrons to bring them rare manuscripts, he spent 10 more years in different places of the Greek-speaking parts of the Ottoman Empire. It was probably from 1620 to the end of 1650 that he copied, rewrote, translated, commented, exchanged chemical recipes of simple medicines as well as of the philosophical stone.

Athanasios tried all his life to join the East and the West together as far as religion, philosophy, languages and chemical knowledge too are concerned. Moreover, in the case of chemistry, he was making the past and the present join together: Alexandrian chemical recipes in his papers are mixed with contemporary French ones, Turkish with Italian, ancient with demotic Greek ones. Nevertheless Athanasios belonged to his time, interested in chemistry - a more and more fashionable science -, and not contenting himself with the old or new writings but frequenting concrete places and living with his contemporaries (scholars and craftsmen). He was in the midst of several networks of people from different social statuses and different interests. His handwritten chemical papers expressed quite well this mixture as well as the complex result of the diffusion of byzantine chemical practices and concepts until the seventeenth-century.

Session Title: Circulation And Communication Of The Chemical Knowledge In The Greek-Speaking Communities From Antiquity To The 17th Century

NATURAL PHILOSOPHY AND ALCHEMY IN THE BYZANTINE PERIOD: A CONTROVERSIAL RELATIONSHIP

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Abstract

This paper addresses a significant void in the current historiography of science by surveying and mapping a previously unexplored area: the relationship between alchemy and natural philosophy in the Byzantine era. Our study is based on the examination of the life and works of the scholars who presented works on both natural philosophy and alchemy.

The main questions we examine in this paper are the following: How the ancient and Christian philosophical traditions were combined with the alchemical? In this new context, what was the artificial and what was the natural? What challenges did the artistic world offer to the category of the natural? Which was the main theoretical approach on the relation between knowing and doing? Which was the byzantine conception of matter and, based on this, did the alchemical techniques imitate nature or attempt to change it?

And finally, how the maker-craftsman attempted to change a nature which was created by the God-Creator.

Session Title: Circulation And Communication Of The Chemical Knowledge In The Greek-Speaking Communities From Antiquity To The 17th Century

OPERATING IN AND THROUGH THE WORD OF GOD: READING THE ALCHEMICAL TREATISES OF STEPHANUS OF ALEXANDRIA AND THE COSMOLOGICAL-THEOLOGICAL WORKS OF JOHN PHILOPONUS SIDE BY SIDE

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Abstract

Greek alchemy presents a great deal of open questions and unresolved research problems. The puzzling multiplicity of designations (alchemist, astrologist, astronomer, medical author, Neoplatonic commentator of Aristotle) attributed to one and the same person, known as Stephanus the Alexandrian philosopher, is just one blind spot among many others, which simply remind us how far we have yet to go in order to (re)construct a comprehensive account of the emergence, and the numerous mutations, of that patricular field of knowledge which has come down to us, through a certain number of monuments of discourse, under the names of “chrysopoeia”, “divine art” or plainly “philosophy”.

This paper aims at contributing to the apprehension of the historical significance that could be ascribed to certain syncretistic intellectual traditions, and social-cultural movements too, which flourished during the Late Antiquity and the Early Byzantine Era, by opening up an intertextual domain crossing the (retrospectively applied and firmly established) boundaries between theological and natural-philosophical discursive practices.

Reading one of the most influential Greek alchemical works ever, Stephanus’ nine alchemical Lectures (or seven Lessons, according to Maria Papathanassiou), side by side with John Philoponus’ De opificio mundi, as well as his main surviving Christological treatise (Diaetetes), we may re-activate a dynamic fabric of relationships between the production of knowledge concerning cosmos and that of knowledge concerning God, in the intricate knitting structure of which the poetic language and the devotional rhetoric of Stephanus the alchemist seem to perform quite different functions from those expected of elements habitually (in our own societies) regarded as merely ornamental, and as such incidental and eradicable. Stephanus’ ‘mystical chemistry’ is part of a Christian philosophy, of one of the many, actually, Christian philosophies, surfacing amid heated controversies, and only insofar as it is defined as part of such a whole alchemy can lay credible claims to being no longer a delusionary art, but a field of knowledge amenable to purposeful reflection and rational argumentation.

Session 38

1644–2014

370° ANNIVERSARY OF TORRICELLI'S *OPERA GEOMETRICA*

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370° years passed since the publication of the *Opera Geometrica* (1644, Massa & de Landis, Florentiae, in 4 main parts) by Evangelista Torricelli (1608–1647). The publication also involved him in a controversy with de Roberval (plagiarizing *quadrature*); Torricelli's was arrived at independently. The *Opera* noticeably adopts both [...] *in quibus Archimedis doctrina* [...] approach and a generalization of the *indivisible* within pure geometry–mathematics, including calculations and *ad absurdum* proofs, for describing *curvilinear indivisible, sphaera et solidis, motu gravium, parabolae and cycloidis*. He proved theorems (*parabolic segment*) using geometry–mechanics of the ancients (*Concordantia praecedentis demonstrationis cum doctrina Archimedis*) and then *indivisibles* (*acute hyperbolic solid*). Particularly an Archimedean theorem (Pr. 24) was proved (Pr. III) in 21 unlike procedures (11 by *exhaustion*, 10 by *indivisibles*). Torricelli avoided algebraic *plus*/*minus* for geometrical *componendo/dividend*, so working by ratios on geometrical segment; *idem* for the line up segments and shift position without rotating using *simul*, e*t,* and c*um*. Torricelli also presented theorems on centre of gravity, ballistics and practical hydrodynamics. Among them extremely valuable is his mechanical principle as a criterion of equilibrium on the impossibility for a centre of gravity (system of equilibrated bodies) to descend for any virtual movement. Such a criterion it had a vital role in the history of mechanics being the foundation of the modern *principle of virtual work*. Without considering the great job by Duhem, Torricelli left little interest among historians who most focused on commemorative and maths themes (*Spiral*, *Tangent Indivisibles*). Mainly focusing on *Opera Geometrica*, we would like to discuss:

Torricelli' intellectual geometrical matrix and international heritage encourage a new reflection of the interdisciplinary fields *history of science* and *communicating* on its own history and self–identity.

Session 38: 1644–2014 - 370° Anniversary of Torricelli's *Opera Geometrica*

CONGIUNTI CONCEPT BODIES IN TORRICELLI'S *OPERA GEOMETRICA*

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In 15th-16th the idea of barycentre of a single body was generalized to a compound bodies, as well, and often without specify how two or more bodies were aggregate. S*cientia de ponderibus* were the science of the equilibrium of single and aggregate bodies (*aggregati*). In *Discorsi e dimostrazioni matematiche* Galileo attributed to Archimedes the idea of treating ex-*suppositione*, e.g., the ropes from which bodies are suspended, as parallel (Galileo 1638. *Dialogues Concerning two new sciences*). He proposes an approach to the centre of gravity on *aggregate* bodies that when subjected to force-weight only move toward the centre of the Earth. Thus he presented (*Ivi*, III Day) the centre of mass of an aggregate of bodies, subjected to weight only, as tending to move toward the centre of the Earth.

Torricelli, in his *Opera geometrica* seems to bring Galileo's position to the extreme situation. He assumed that the bodies could be placed, not on the Earth, *but at infinite distance from it or that the cord*, by which heavy bodies are suspended, are actually parallel. Torricelli thought that a result should be justified by means of mathematical calculation, and "[…] not for this fails the proportion of the figure already demonstrated (Torricelli 1644, "Ad lectorem Proemium" in *De Dimensione parabolae solidique Hiperbolici,* p. 9). Since the cords by which bodies are "congiunti" to the lever are infinitely long (e.g., not finite) he made a particular choice, differently from Galileo, toward mathematical aspects of the theory showing all his capability of abstraction, as well as, his ability to relate it to reality (*Ivi*, p. 11).

In my talk I present an historical investigation on the role played by the abstraction in Torricelli's proof concerning "congiunti" bodies and their distance from the Earth in *Opera geometrica*.

Session 38: 1644–2014 - 370° Anniversary of Torricelli's *Opera Geometrica*

TORRICELLI'S MECHANICS IN *DE MOTU GRAVIUM*

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The complete title of this text published in 1644 in Torricelli's *Opera* is *de motu gravium naturaliter descentium, et projectorum libri duo. In quibus ingenium naturae circa parabolicam lineam ludentis per motum ostenditur, et universae projectorum doctrina unius descriptione semicirculi, absolvitur.* It seems that a manuscript of the text has been given to Galileo in 1641. The texte given in the *Opera* is composed of two books. The title of the second doesn't leave any doubt about its content. Its title is *De motu projectorum* and the author studies the parabolical fall. The first book entitled *De motu gravium naturaliter descendentium* focuses on the motion on the inclined plane and opens onto the parabolic motion.

We will analyze both parts of this text as well as relations between them with help of letters published in the *Opere dei discepoli di Galileo Galilei*. Finally, we will compare the text of Torricelli to that published in 1624 by Gregory of Saint-Vincent, *Theoremata mathematica scientiae staticae of ductu ponderum per planitiem recta and oblique horizontem decussantem* which Galileo certainly had but which is difficult to decipher because these thesis were intended to be defended by students.

It is difficult to determine if the disciples of Galileo were awared of this text. They mention the famous text of Gregory of Saint-Vincent, *Opus geometricum* which, although already written in 1624, was published only in 1647. But they do not cite *Theoremata mathematica.*

Session 38: 1644–2014 - 370° Anniversary of Torricelli's *Opera Geometrica*

WHAT WERE THE ISSUES OF THE QUARREL ABOUT TORRICELLI IN FRANCE?

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In his rector address of 1701 in Latin at the University of Basle, the already aged Jakob Bernoulli gave a rather long explanation about the quarrel made to Torricelli by French mathematicians. Torricelli had died in 1647, and the quarrel on indivisibles and the use of the cycloid curve was serious only in the fifties of the century, involving Fermat, Pascal, Roberval, but also the British Wallis, etc. If Jakob went commenting on this case, it is certainly because he wished to discuss other quarrels, for example the bitter one he had with his brother Johann (they separated in 1694, and never met again), and perhaps too the quarrel that had recently appeared, with the claim Leibniz had plagiarized Newton. The interesting fact, for any social study of science, is that the two last quarrels occurred during a time when academies of sciences existed, even if such institutions still were fashioning their ways of conduct to obtain a kind of judgment on good scientific procedures. Earlier, the only way for mathematicians to publicly quarrel was through books, but also by presenting competitions, as Pascal did with a price about the cycloid, and how he refused to consider Wallis as a winner. On an epistemological point of view, the issue was no longer to consider problems as important as such in mathematics, but to discuss the occurrence of methods, and even of a completely different language like algebra. This is the point about the so-called Torricelli quarrel, to know if indivisibles could fashion a method, even when everybody wished to replace Cavalieri's indivisibles by "thick" indivisibles, leading to Riemann sums. If Jacob Bernoulli acted as a historian in this event, he used the quarrel to tell differences between good and bad ways in the practice of mathematics, once Calculus had been established.

Session 38: 1644–2014 - 370° Anniversary of Torricelli's Opera Geometrica

A HISTORICAL ANALYSIS OF TORRICELLI'S PRINCIPLE IN MECHANICS (1644)

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The common interpretation of Torricelli's principle is that it is a criterion of equilibrium which claims that it is impossible for the centre of gravity of a system of bodies in equilibrium to sink from any possible movement of the bodies.

> *Praemittimus. Duo gravia simul coniuncta ex se moveri non posse, nisi centrum commune gravitatis ipsorum descendat* (*Liber primus de motu gravium naturaliter descendentium*, *Opera geometrica*, p. 99).

This criterion had a vital role in the history of mechanics. It represents a generalisation of the principle according with a body is in indifferent equilibrium if its centre of gravity cannot sink. Torricelli's generalisation states that if one can determine the centre of gravity of an aggregate of rigid bodies considering the aggregate as one rigid body, then this point is effectively a centre of gravity. Therefore, the possibility to move the centre of gravity and so to vary the configuration of the rigid aggregate determines the equilibrium. While it is simple, intuitive, and at first glance acceptable, a careful examination still raises concerns with regard to the mathematical and logical organisation of Torricelli's mechanical theory. This notwithstanding, and despite the secondary literature, Torricelli's *Opera Geometrica* attracted little interest from 20th century–historians; most focused on commemorative, mathematical themes. Agostini's reconstruction and Duhem's *Statique* are distinguished exceptions as deep and thoughtful study on Torricelli's mechanics.

Based on recent publications on mine and in order to highlight the relationship physics-mathematics, I examine the historical development of the centre of gravity concept for simple and compound bodies according to Archimedes (*Suppositioni and Definitioni of* Book I, *On the equilibrium of planes*) and Torricelli (*Opera geometrica*). Particularly I show that the organization of Torricelli's mechanical theory is similar to that of Archimedes, both for techniques and structural approach in proofs, as well.

SESSION 39

SCIENTIFIC SOCIABILITIES: BEYOND THE "REPUBLIC OF SCIENCES"

Organizers: Lorelai Kury, Patrice Bret

The aim of this session is to put under scrutiny the networks of sociability and exchange of men of science of the 18th and 19th centuries, from the point of view both of their positions in what we may call the "Republic of Sciences" as of their relationships to friends, relatives, instrument-makers, booksellers, patrons and agents of the State (revealed through correspondences, diaries, field-logs and so on). In four case studies, we intend to show that far from being confined to networks of "peers", their social worlds are permanently crossing those of such other actors, producing sociabilities that cannot be separated from their scientific working lives – in fact, they are interwoven and reciprocally constitute each other. In the cases we present, such extended sociabilities indeed help to explain career paths, expectations, motifs, and the very scientific output of the characters. We should note that this approach does not boil down to a simple recognition of the importance of "extra-scientific" factors, but it also allows us to realize anew the importance of the dynamics of the "Republic of Sciences" in situations where it has been downplayed in favour of these very factors.

Session Title: Scientific Sociabilities — Beyond the "Republic of Sciences"

SCIENCE AND FRIENDSHIP IN THE FOREIGN CORRESPONDENCE OF GUYTON DE MORVEAU, 1776-1815

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Abstract

A prosecuting attorney in Dijon, Louis-Bernard Guyton de Morveau (1737-1816) was elected by the local learned society as a representative of the provincial High Court and a poet, prior to becoming an amateur chemist in 1764. A few years later, he was both the Vice-Chancellor, then Chancellor of the Academy, and a major French chemist.

Morveau's foreign correspondence started in 1776 – the very year he started teaching his famous course of chemistry, translated into German and Spanish – and increased in the following decade while he was preparing the *Dictionnaire de Chymie* of the *Encyclopédie méthodique*. For that purpose, Morveau developed a network of foreign scientists, with whom he exchanged letters, books and minerals. In Dijon, he set up a local group of translators so as to put into French foreign works first published in Latin, Swedish, German, Italian and English. Five volumes were translated and published in Dijon, alongside dozens of papers in French learned journals. Many letters dealt with the acquisition of the original works from the publishers and booksellers, and their shipping, or with linguistic matters.

During that decade up to the French Revolution, the letters from or to some thirty-five foreigners reached nearly the half of the total amount. A few foreign scientists have first come to visit Morveau or attend his course of chemistry, prior to correspond with him. Despite of a few plans, himself never travelled to see them abroad; but a few of his friends from Dijon acted as his private ambassadors there. With his major correspondents – such as Torbern Bergman (Uppsala), Richard Kirwan (London, Dublin), Lorenz Crell (Helmstedt), Marsilio Landriani (Milano), Francisco Angulo (Madrid), Martinus Van Marum (Haarlem)… – links of friendship were eventually built. The letters give evidences of that pen-friendship, that often began with a mirror election in Dijon and foreign Academies.

Session Title: Scientific Sociabilities — Beyond the "Republic of Sciences"

TRAVELS, INSTRUMENTS, SCIENTIFIC BOOKS AND THE CIRCULATION OF KNOWLEDGE IN PORTUGUESE AMERICA (1750-1760)

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Abstract

In the year 1752, as part of the preparations for the expeditions that would demarcate the frontiers between Portugal and Spain in the Southern part of the American continent, which were settled during the Madrid negotiations of 1750, the *Lampadoza* (which was to set sail from Rio de Janeiro to Castillos Grandes) was filled with boxes carrying material necessary for the fieldwork. We know that many of these boxes were packed with instruments, books, utensils, notebooks, ink and paper that would be used in the surveying works. The careful identification of the scientific artifacts and the astronomers involved in this expedition (in this case the Jesuits Bartolomeu Panigai, Bartolomeu Pinceti and Estevão Bramiri, besides the cosmographers and engineers Miguel Angelo Blasco, Custódio de Sá Farias and Miguel Ciera), allows us to revisit some of the current interpretations of the historiography of science relating to Portuguese colonization in mid-18th century. The presence of astronomers and mathematicians in the surveying commissions, especially those operating in 1750s Portuguese America, has always been considered just a result of immediate interests concerning the construction of territory. Our hypothesis is that a careful look at the materials that were carried, which in fact allowed the building of an astronomical observatory in these remote parts of America, leads to the conclusion that their astronomical observations and practices were connected to contemporary European scientific concerns. Moreover, imperial administrative records that we are currently collecting may help to identify the possible connections between astronomers operating in Europe – be it in Portugal or other centers –, scientific institutions and the very State, connections that led to the commissioning of these specific surveyors and the selection of materials by them (the instruments and books that lent support to the work undertaken in these remote parts of America).

Session Title: Scientific Sociabilities — Beyond the "Republic of Sciences"

"A PARROT THAT SPEAKS ITALIAN": THE CORRESPONDENCE OF G. A. BRUNELLI IN 18TH CENTURY AMAZON

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Abstract

In the wake of the detailed partition of South America between Portugal and Spain accomplished in 1750, both powers commissioned several European astronomers to travel to the continent in order to do the necessary fieldwork. They were enlisted on the basis of a complex interplay of availability, experience, personal and institutional affiliations and perceived loyalties. Bolognese astronomer and secular presbyter Giovanni Angelo Brunelli (1722-1804) was one of the envoys of the Portuguese Crown, and conducted extensive fieldwork in the Portuguese Amazon from 1753 to 1761. Afterwards, he remained in Lisbon until 1769, becoming a professor of mathematics in at least two institutions that operated under direct royal patronage. The Brazilian National Library keeps a rich collection of letters received by Brunelli during his American sojourn, along with several of his manuscripts on a diversity of topics, including Latin treatises on mathematical questions. Brunelli's correspondents included relatives, debtors, members of the Bologna Observatory, academics, the executor of his brother's will and political figures. An analysis of the contents of this bulky correspondence offers us a glimpse of the social worlds of the astronomer and his range of concerns: He is asked to discuss demonstrations of mathematical theorems, to provide for his widowed sister-in- law and her orphaned children, approving the auctioning of his deceased brother's belongings, to advise career choices of younger men of sciences and letters, and even to, in a most intimate and poignant passage, search for and dispatch a parrot that could speak Italian. We sustain that all of this is integral to a proper understanding of Brunelli's commissioning by the Portuguese and his scientific activity, which unfolds amid inseparable and all-encompassing concerns about securing a place in the "Republic of Sciences" along with earning a living, finding patrons and clients, and ultimately integrating worlds apart.

Session Title: Scientific Sociabilities — Beyond the "Republic of Sciences"

THE RELATIONSHIP BETWEEN PARIS AND "LA PROVINCE" IN THE CORRESPONDENCE OF AUGUSTE DE SAINT-HILAIRE (1779-1853)

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Abstract

Auguste de Saint-Hilaire was born in Orléans in 1779 and died there in 1853. Coming from a noble family, he lived close to Hamburg during his youth, which allowed him to acquire familiarity with the German language and culture. In 1816, on the occasion of his departure for Brazil, he was 37 years old and possessed solid botanical knowledge, having already published on French flora. At this time, besides the friendships he formed in Orléans, he had contact with A.-L. de Jussieu, from the Muséum d'histoire naturelle de Paris, was a friend of K.-S. Kunth - a collaborator of Humboldt's - and had ties to the mesmerist J.-Ph.-Fr., who was assistant-naturalist and future librarian of the Muséum. He was a correspondent for the important Swiss botanist A.-P. de Candolle and was also very close to F. Dunal from Montpellier. In other words, he was well integrated into the European scientific milieu. In spite of the illness that plagued the years of his return to France, his work on Brazil is extensive. He himself claimed that his disease made him search for the better climate of Montpellier. His travels to and from Montpellier made his work in Paris less intense and made difficult some important activities, such as correcting the proofs of his books, published by Parisian editors. Besides this, his presence at the Faculté des Sciences and the Académie des Sciences was diminished. Even so, he was very present in the network of Natural History in the capital, Paris being the center for Natural History research and the obligatory path to obtain positions, advantages, opportunities, financing. Furthermore, the great botanical collections and libraries were there. His correspondence indicated how he dealt with living far from the ideal work conditions.

Session 40

REUNITING HISTORIES: THE HUMANITIES, SCIENCES AND ARTS

Organizer: Rens Bod

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The debate about two cultures, that was sparked off by C.P Snow in 1959, has become history. The divide he construed between the natural sciences and the humanities/arts has been much criticized, and historians of science have thoroughly demonstrated that histories of science and histories of culture are mutually constitutive. Nevertheless, the historiographies of the sciences and of the humanities/arts still tend to be separate from each other. With this Session, we approach the divisions from a new perspective: We address the shared traditions, values and virtues in the humanities, sciences and arts, and their mutual relations and reconfigurations.

In the first paper, Rens Bod will argue that the search for invariants and patterns has not been exclusive to those disciplines that have been acknowledged as "nomothetic" or "erklärend", but rather reaches far into the humanities' own traditions, suggesting a common history of humanities and science. The second paper by Sven Dupré focuses on the relation between artisans, humanists and scientists, arguing that artisans' adoption of humanist techniques of organizing the codification of craft knowledge was central to the emergence of the new science in the early modern period. Calling into mind the role of experimentation in 19th-century life sciences, Julia Kursell will finally discuss the outreach of experiment as a modus operandi, which many emerging disciplines in the humanities consequently embraced, but which, in addition, challenged the study of arts, music and literature.

The opposition between humanities and science, as it has been re-invented since the 19th century, has had far-reaching consequences for the historiography of science up to the present, effacing the historiography of the humanities from the scope of history of science. At one level, this Session invites historians of science to re-engage with the history of the humanities/arts. At an other, it asks how newer emphases on practices and technologies in science, humanities and the arts can contribute to this wider historical vision of knowledge.

Session 40: Reuniting Histories: The Humanities, Sciences and Arts

THE EMPIRICAL TRADITION IN THE HUMANITIES

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Contrary to common wisdom, the search for invariants and patterns has not been exclusive to the sciences, but rather reaches far into the humanities' own tradition. In my talk I will try to sketch this empirical, pattern-oriented tradition by discussing practices from various humanities disciplines. Drawing from my recent book *A New History of the Humanities* (OUP, 2013), I will argue that the search for invariants and patterns is found in, for instance, structuralism in linguistics (Saussure, Jakobson), formalism in literary theory (Propp a.o.), harmonic analysis in musicology (Schenker, Lerdahl), stylistic analysis in art history (Wölfflin, Riegl), stemmatic analysis in philology (Lachmann, Greg) and in the *Annales* school in historiography (Febvre, Bloch, Braudel). I will argue that the pattern-searching humanistic tradition has formed a continuous tradition since the early modern period and that it has influenced the modern sciences: the early Rankean notion of historical objectivity became the model for scientific objectivity, the philological model of a tree of texts with a common root was adapted by biologists for describing zoological phylogenies, and the syntactic definition of a language was used by computer scientists as the pattern for the structure of the first programming languages. These examples raise questions about the nature of the divide that has been created time and again between the humanities and the sciences. In particular I will go into the question as to whether any radical distinction can be made between pattern-oriented approaches in the humanities and the sciences.

Session 40: Reuniting Histories: The Humanities, Sciences and Arts

THE ARTS AND THE SCIENCES IN THE EARLY MODERN PERIOD

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In the early modern period the division between the arts, the sciences and the humanities was re-configured in fundamental ways. Two re-configurations have been widely recognized in the history of science. First, historians of Renaissance intellectual culture have emphasized the role of humanism in the development of the ‚new science', among other things, revealing the importance of humanist techniques of editing and reading texts to the knowledge practices of early modern mathematicians and natural historians. Second, the contribution of the arts to the sciences is a question which has been on the research agenda of historians of science and technology since the generation of Leonardo Olschki and Edgar Zilsel. However, exactly how artisanal and scholarly cultures mingled in this period is a question which has received widely variant answers, even among historians agreeing that this mingling was essential to the emergence of the new science. Some historians have emphasized the social elevation of the craftsman as the central issue, others the emergence of spaces, such as the arsenal, as ‚trading zones' between the two cultures; still others the taking up of challenging objects from contempary technologies for purposes of study in mathematics and mechanics. This paper raises the question of the second re-configuration (between the arts and the sciences), but formulates a different answer by placing the emergence of artisanal literacy at the centre of the stage. Scrutinizing examples of the increasing numbers of writings by artisans codifying the knowledge of their art and craft in the early modern period, this paper argues that artisans' adoption of scholarly and humanist techniques of organizing the codification of craft knowledge was central to the emergence of the new science.

Session 40: Reuniting Histories: The Humanities, Sciences and Arts

A DIVIDE IN THE HUMANITIES? EXPERIMENTAL METHODS AND OBJECTS IN THE STUDY OF THE ARTS

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In the mid-19th century, the life sciences adopted experimentation as their basic methodology. As research into the "experimentation of life" has shown, the outreach of experiment as a modus operandi, which ensued from the study of life in new laboratory-based disciplines such as experimental physiology, did not make a halt before human sciences and the humanities. It even led to the formation of new disciplines, such as experimental linguistics, the psychology of music, and experimental aesthetics. This contribution will use the example of Russian Formalism in order to discuss experimental practices in the study of literature and poetry. As can be observed, the divide between sciences and humanities slowly migrated into this area of the humanities. The claim that the study of art should be based on exact, empirical study that was a commonplace among the early Formalists led to different approaches within the study of language and literature, which eventually tore the field apart. This example will serve as the basis for some reflections on the ways in which the humanities themselves have mirrored the divide and thereby contributed to it. As it will be shown, the arts had meanwhile become experimental and thereby posed common problems to both approaches.

Session 40: Reuniting Histories. The Humanities, Sciences, and Arts

CHEMICAL EXPERTISE AND THE FINE ARTS

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In 1981, Joseph Riederer advanced the hypothesis that chemical analysis of works of art took off around the end of the eighteenth century. Three major circumstances were instrumental: the widespread interest in the archaeological excavations in Italy and Greece; the contemporary development of quantitative analytical chemistry; and the creation of specialised archaeological societies. Before long, chemical expertise became accepted in the scientific community and even institutionalized in archaeological museums.

Yet, the situation appears to have been quite different for chemical research related to current artistic debates or contemporary fine arts. Although chemists were convinced that their expertise was crucial in establishing artistic practices on solid ground, artists and connoisseurs pointed to the unreliability of chemical experiments, and contrasted the technical information provided by chemists with the genuine understanding of art through consideration of its artistic and historical meaning.

Appreciation of chemical expertise started to shift with the introduction of synthetic dyestuffs in the last decades of the nineteenth century. Artists were unsure about the quality of industrial painting materials and were eager to obtain advice from chemists. Also the renewed interest in the painting techniques of the old masters created opportunities for chemists to study the durability and the preservation of works of art. Chemical expertise furthermore proved to be useful in the detection of fraud and forgeries.

In this paper we analyse the establishment of chemical expertise and its reception among artists and connoisseurs from the late eighteenth to the early twentieth century. Examples show how chemical experts for a long time –and largely unsuccessfully– attempted to transcend the boundaries of chemical knowledge to enter artistic debates about aesthetics and meaning. It will be shown how the recognition of expertise depended on the formation of a professional group of experts, and on the erosion of previous cultures of expertise.

Session 41

SPACES AND MODES OF COMMUNICATION: POPULARIZATION SCIENTIFIC CONCEPTS WITHIN HISTORY OF SCIENCE, EDUCATION & SOCIETY

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Like all sets or groupings, a society as a whole and education as a part of society is also defined by relations among its elements, in our case of education, among individuals who compose it. If we want to get closer to it we should try to learn about as many of its elements as possible. To understand a society, relation inside the science (education, modes of communication), an exam within how a physical environment, history, culture and interpersonal relations that generate social values and institutions affect it: industrialization pollutes the environment, education affects culture and social taboos shape our interpersonal relationships and consequently transform them. Recently powerful tools have emerged helping to understand society and their subsets better; but still a huge gap between reality and our understanding of it. Focusing on sciences and their inter-relationships, a larger base of analysis should be adopted: history, historical epistemology, communication and foundations of sciences. Thus, a multidisciplinary teaching based on large themes–problems toward a scientific education, science & society studies, based on different formulations of the same theory would be appreciated, and re–thinking on the problem of *theorization* and of modelling within educational problems. Thus, *how science and its recreational modelling can work in order to present science and correlated technologies in an exciting manner? A popular science addressed to a large audience exploring the fascinating world of pure and applied sciences, really exists?* In this context, the correlated relationship between science, society, communication and science education and institutions will be discussed. The main discussion on:

- Developing the new teaching paradigms and strategies of teaching/learning especially connected with modern technologies and intelligent systems.
- New pedagogies and didactic for science teaching/learning based in multidisciplinary approach

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Session 41: Spaces and Modes of Communication: Popularization Scientific Concepts within History of Science, Education & Society

WHAT IS THE "DRIVING FORCE" OF CHEMICAL REACTIONS? THE ENERGETICAL ANSWER OF MARCELIN BERTHELOT

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Historiographical accounts of the work of Marcelin Berthelot (1827-1907) usually analyses *separately* two kinds of activities: organic synthesis, the French chemist's first concern, and his thermochemical work. Why such a change of interest? We will show that thermochemistry takes its necessity from Berthelot's desire to foresee chemical action, which is a great challenge, in the middle of 19th century. Much hope is placed on synthesis and chemical industry to transform the conditions of existence. What substances can we expect to create? From which reagents? Finally: *how can we tell a chemical reaction will occur?*

Berthelot's answer relies on thermochemistry, particularly on his principle of maximum work: a chemical change is spontaneous if it is likely to liberate energy, in the form of heat! *This amount of heat provides the measure of the process' spontaneity*. As a consequence, an endothermic reaction can't be spontaneous: it requires heat, i.e. energy, to occur ... The mechanical analogy is obvious: when I drop a ball, it tends to fall, to minimize its energy. Why shouldn't it be the same for chemical action?

Today, we know Berthelot was wrong. To know whether a reaction will occur, we have to consider the free energy, i.e. to take *entropy* into account. This is a source of perplexity for many students ... Are there two driving forces of reactions: energy decrease and entropic creation? This can explain why a mistake such as Berthelot's is so common. We will see that its source is a wrong definition of the system. And that one concept only is necessary to account for chemical change: entropy.

Session 41: Spaces and Modes of Communication: Popularization Scientific Concepts within History of Science, Education & Society

POPULARIZATION OF CHEMISTRY IN THE 18TH CENTURY: BETWEEN SCIENCE AND SOCIETY

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Within the framework of the will of the State to develop the economy of France, the Chemistry developed highly in the country during the 18th century. Much was expected of it, in order to serve arts in particular. Thus its diffusion within the society was encouraged to reach different publics (scholars, curious, doctors, craftsmen, investors …). And the chemistry was popularized: 1) through the concept of "chemical affinity" which quickly spread to the biological phenomena and even the sociological ones; 2) through the success of Rouelle's teaching which a whole generation of chemists and intellectuals attended; 3) through the very coherent set of the numerous chemical articles of Diderot's and d'Alembert's *Encyclopédie* which presented theoretical elements of chemistry as well as practical ones. The results were the constitution of an autonomous chemical science, which became at that time a full discipline, and a very effective application of chemistry to crafts. Thus, from 1740's to 1780's, around 3000 students are trained in chemistry per year in Paris, and many chemical manufactures came out. So chemistry was a science which joined together several social networks and covered a large part of technical and scientific knowledge. The creation of *Annals of Chemistry* in 1789 illustrated the fact that chemistry was much more present outside of the *Académie Royale des Sciences* than inside. Yet the *Académie* was created in 1666 to express a kind of symbolic fence between producers and consumers of sciences; such a distinction was not anymore relevant by the end of the 18th century.

Session 41: Spaces and Modes of Communication: Popularization Scientific Concepts within History of Science, Education & Society

THE PROBLEM OF DEFINING A CLASSICAL THERMODYNAMIC SYSTEM. SCIENCE EDUCATION & COMMUNICATION

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Most of the authors of books deal with classical thermodynamic giving, in the first pages of their book, the definition of the thermodynamic system (sometimes distinguishing the concept of system and thermodynamic system). A large part of them even insist on the importance of its definition in the study of a thermodynamic problem. But, reading the definitions, we understand that this concept is very abstract and that its definition does not seem to be universal. To highlight the difficulties of this concept we propose a study of the thermodynamic system through 50 items (level L2 and more) deal with general physics, chemistry, biology and industrial thermodynamic. A historical analysis of the concept of system is firstly proposed. Then through the various proposed definitions we try to present necessary for the definition of system properties. We will also discuss what programs (before bac.) imposed on the importance given to the definition of thermodynamic system and skills due to the student on this point. Finally, to support our study, we will illustrate the analysis of a subject of competition (CCP 2005 Contest Deug). We will analyze the topic sentence and two corrected can easily find on the net. These corrections, divergent results highlight the ambiguity of the choice of the system and the multiplicity of responses depending on the system selected. We conclude our analysis by presenting the proposed 35 students CPGEs or Master Education results when faced with this problem.

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Session 42

MIXED MATHEMATICS, MISSED MATHEMATICS: MATHEMATICAL INSTRUMENTS, MULTIPLE MATHEMATICAL TRADITIONS AND MISUNDERSTANDING IN EARLY MODERN EUROPE

Organizers: Samuel Gessner, Michael Korey

Mathematical instruments became a common concern for a variety of actors during the Renaissance. Mathematical theoreticians and practitioners, instrument makers, printers, mathematically affine humanists, patricians and noblemen (not always exclusive categories) would often share a curiosity about instruments, and not seldom an enthusiasm for them.

Nevertheless, the ways of apprehending their uses and the mathematical knowledge required to make or apply them differed, often according to the actors' social framework. The diverse sociocultural settings in which instruments were molded constitute a fascinating and complex 'mathematical terrain' that has become increasingly an object of history of mathematics and instrument studies over the last decades. This session proposes to elucidate an aspect that has rarely been addressed to date by focusing on what happened when instruments were miscommunicated: when knowledge associated with them got changed or lost, when instruments became defective in transit between settings, when – so to speak – 'mathematics went missing'. This could happen for a variety of reasons with sometimes drastic consequences: instruments might fall short of expectations, not be used, or could be feared – all of which need not necessarily have dampened their fame. This facet of history – the stories where instruments failed, were missing or were 'misunderstood' – should afford us to the opportunity to better profile the variegated knowledge communities mentioned above as well as their various knowledge traditions and modes of communication.

With this symposium we intend to strengthen instrument studies as a part of current research topics in the history of science and material culture. Above all, we aim to provide a forum for bringing together scholars who have worked on mathematical instruments, often in the context of the Scientific Instrument Commission, with historians – of art, visual representations or the transmission of knowledge who study the settings where instruments are seen to play a fundamental role.

Session Title: Mixed Mathematics, Missed Mathematics — Mathematical Instruments, Multiple Mathematical Traditions And Misunderstanding In Early Modern Europe

EDMUND STONE AND THE STUDY OF MATHEMATICAL INSTRUMENTS

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Abstract

In 1723 Edmund Stone (1695?-1768) published *The Construction and Principal Uses of Mathematical Instruments*, which was essentially a translation from the French of Nicolas Bion's *Traité de la construction et des principaux usages des instrumens de mathématique*, first published in 1709. In the translator's preface, Stone defined mathematics both as a science and as an art, with regard to its theory and practice, respectively. Mathematical instruments played an important role in connecting these two sides of mathematics. This led Stone to discuss the usefulness of practical mathematics and, in turn, of mathematical instruments, since the knowledge of the former could be reached through the knowledge of the latter. Therefore, the construction and uses of mathematical instruments could be regarded as one of the most useful branches of knowledge in the world. In the context of the training in mathematical instruments, this contribution explores the connection between the theory and practice of mathematics as presented by Stone.

However useful it might be, Stone lamented the lack of a general treatise, like Bion's, in English. Although this could explain why Stone translated Bion's treatise, his book cannot be said to be just a bare translation. As the title of the book indicated, Stone incorporated a number of instruments that had been omitted by Bion, in particular those invented or improved by the English. In fact, in the supplement added to the second edition of his book in 1758, Stone insisted on the superiority of the English over the French in the making of mathematical instruments, to the extent of making the distinction between "English instruments" and "French instruments". Therefore the study of Stone's book provides the opportunity to examine the English and French traditions in the field of mathematical instruments.

Session Title: Mixed Mathematics, Missed Mathematics — Mathematical Instruments, Multiple Mathematical Traditions And Misunderstanding In Early Modern Europe

ONE OR TWO-DIMENSIONAL THOUGHT? THE CASE OF SIXTEENTH CENTURY DUTCH 'PRACTITIONERS'

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Thinking by means of tables, according to Michel Foucault in *Les mots et les choses* (1966), is characteristic of our modern thought, as opposed to medieval thought, which for Foucault amounted to thinking by list. But who exactly are the 'medieval' and 'modern' he was referring to, and how did this transition come about? I would like to show that a particular group in a particular country achieved this transition around 1600: practitioners in the Northern Netherlands. By 'practitioners', I refer specifically to the middle class of skilled artisans, shopkeepers, mathematically proficient sailors and local merchants – that is to say those persons who could become members of *rederijkerskamers* (lit. 'chambers of rhetoric').

In this talk I will argue that we should see tables as instruments: objects we can take along wherever go; that allow us to reach the right page, just as we need to read the right graduation on an astrolabe; or that point us to the right case such as we would find a star.

The instruments used by 'medieval' practitioners in the Low Countries carried one-dimensional thought (e.g. portulan charts) but we can date a change in the sixteenth century. At that time they start to include a scholarly two-dimensional way of thinking (e.g. triangulation for mapmaking). This change opens the way or is itself a consequence of new skills (e.g. here the offshore navigation compared with cabotage). Perhaps the dichotomy between list and table can be somewhat nuanced by astronomical tables, or logarithmic tables (are they truly tables or rather lists of lists?).

A striking parallel will be drawn to a contemporary development in theatre with *spellen van zinne* (1540-50s) or in vernacular grammars such as the sailor-astronomer Frederick van Houtman's grammar of Malagasy and Malay (1603).

Session Title: Mixed Mathematics, Missed Mathematics — Mathematical Instruments, Multiple Mathematical Traditions And Misunderstanding In Early Modern Europe

MATHEMATICAL INSTRUMENTS AT THE SAVOYARD COURT: GIOVANNI BATTISTA BENEDETTI'S MANUSCRIPT ON THE *TRIGONOLOMETRO*

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The design and construction of scientific instruments was an important part of the activity of Renaissance mathematicians. This phenomenon is strongly connected with the foundation, throughout Europe, of numerous princely court collections in the second part of the sixteenth century.

An interesting case in this context is the Savoyard court, where Duke Emanuele Filiberto (1528-1580) founded a *museo-biblioteca* containing many mathematical instruments. Recent studies show that the Duke spared neither cost nor effort to include certain devices in his collection; further, it is possible to document the notable engagement of two mathematicians in Turin, Ettore Ausonio (ca. 1520-ca. 1570) and Giovanni Battista Benedetti (1530-1590), with designing and supervising the construction of a considerable number of mathematical instruments.

After offering a panoramic overview of this context, we shall focus on a particular device, the so-called *trigonolometro*, which Benedetti described in a recently-uncovered manuscript. This measuring instrument had come into the Duke's possession without instructions, and Benedetti, fulfilling his function as a court mathematician, was given the task to describe its use and theoretical foundation. The 78 folios of the manuscript give an interesting insight into this facet of the mathematician's scientific activity, evidencing the close relation between the operation of mathematical instruments and pure geometry. They also reveal the way specialized knowledge and technical objects were communicated among the Duke and his entourage. We will also compare Benedetti's manuscript with coeval authors and sources in Italy and France.

Session Title: Mixed Mathematics, Missed Mathematics — Mathematical Instruments, Multiple Mathematical Traditions And Misunderstanding In Early Modern Europe

THE COMPASS IN TRANSITION: DIVERGENT VIEWS ON A MATHEMATICAL INSTRUMENT IN CARDANO'S AND TARTAGLIA'S CIRCLES

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A mathematical instrument can sometimes be turned into a weapon, as will be argued here with the particular way Cardano and Ferrari used a compass in the context of the well-known polemic pitting Tartaglia against Cardano (1546-1548). Scholarship on Cardano's mathematics is centred above all on diverse approaches to algebra; in this paper, however, an examination of the role of instruments in geometry offers a novel perspective on the divergence between the autodidact Tartaglia and his university-trained opponents. In fact, Tartaglia proposed the challenge of solving a number of Euclidean propositions by means of straight-edge and 'fixed compass' – that is, a compass set to a single, fixed opening. The use of such a fixed compass would likely have been most familiar to Tartaglia given his awareness of the techniques used by artisans and painters. In response to this challenge, Cardano and his pupil Ferrari showed how to reconstruct what they claimed to be *all* of Euclidean geometry ('E così è provato tutto Euclide' according to Ferrari) by invoking only a single fixed opening of the compass. Of course, their argument (in the *Cartelli di matematica disfida* and *De subtilitate*) offered a lot more mathematics than what was strictly 'necessary' for artisans. How should this type of answer be interpreted in a polemic context? In what way could it be seen as an attempt by Cardano and Ferrari to humiliate Tartaglia and deliberately show off their academic superiority? On the other hand, why did they label their work a 'useless subtlety'? Apparently, neither Cardano nor his contemporaries were aware of having reached a very interesting result, at least seen from a retrospective mathematical point of view, because actually this research was appreciated anew only by 18th- and 19th-century geometers such as Mascheroni, Steiner and Poncelet.

Session Title: Mixed Mathematics, Missed Mathematics — Mathematical Instruments, Multiple Mathematical Traditions And Misunderstanding In Early Modern Europe

AN EMPEROR, A PHILOSOPHER, ARTISANS AND MATHEMATICIANS: ADOPTIONS AND ADAPTIONS OF THE MORDENTE-TYPE COMPASS

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This paper focuses on Fabrizio Mordente's multipoint compass (and related instruments), referred to in its day as *compasso magistrale*. To understand its prominent historic role requires reconstituting the various ways this mathematical instrument was received and reinterpreted as it moved across Europe in the decades around 1600. Although recent scholarship (by F. Camerota, A. Meskens and others) has done much to identify the individuals involved and to clarify the development of this special compass, the reasons for its broad appeal, conflicting views of the instrument and polemic exchanges around it still remain obscure to some extent. We propose to shed light on the matter by analysing a series of episodes in the life of the compass: 1. Rudolf II's 'suggestion' to improve the instrument by adding a central point to the compass (Vienna 1575); 2. Giordano Bruno's reading of the instrument as a means to realise ever-smaller fractional parts of an angle and his subsequent dispute with Mordente (Paris 1586, Antwerp 1591); 3. Milles De Norry's piggy-backing off of Mordente's public presentations of the instrument (Paris 1588) with a claim of its great utility for artisans 4. Michiel Coignet's explanation of the Mordente compass in *Neunspitziger Passer* (Antwerp ca. 1600) and *L'uso del compasso* (1608); 5. Georg Galgemayer's *Centiloquium* as the response to a request for a missing user's manual (Nuremberg 1619). Historians have not yet sufficiently examined the mathematical operations and arguments adduced by those involved. The latter belong, as we will show, to particular mathematical subcultures. An emperor, a philosopher, artisans and mathematicians: while praising Mordente's invention, each adapted the instrument's geometric and mechanical properties in his own way rather than adopting the motivation and use proposed by Mordente himself, which can be seen to illustrate the rich variety of understandings of 'mathematics' in the early modern era.

Session Title: Mixed Mathematics, Missed Mathematics — Mathematical Instruments, Multiple Mathematical Traditions And Misunderstanding In Early Modern Europe

MISSING MATHEMATICS IN JOHANNES STABIUS'S PAPER INSTRUMENTS DESIGNED FOR EMPEROR MAXIMILIAN I, 1512-15

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It is well known that in the 1510s, the court astrologer, historian and poet laureate for the Emperor Maximilian I, Johannes Stabius, designed four large, broadside prints for his patron, each presenting an 'instrument' composed of a complex network of curves and lines. Printed in Nuremberg by Hans Springinklee, a member of Dürer's workshop, these sheets have attracted considerable attention from art historians. But as far as I know, no scholar has examined the mathematics of Stabius's instruments. And as far as I know, no one in the sixteenth century reprinted or sought to further develop Stabius's 'instruments'. His complex, visually stunning prints, today extant in only a few copies, lived very short lives as mathematical instruments.

Stabius labeled three of his instruments 'horoscopion', which they are not; he called the fourth an 'astrolabium', which it is not. In this paper, I shall bring mathematics back to Stabius's prints, asking what mathematical tasks they were intended to perform, why they were so strangely named, why they might have been valued by Maximilian's court, and why later sixteenth-century instrument makers such as Sebastian Münster, Peter Apian or Johann Schöner seem to have completely ignored Stabius's instruments. Mathematical tables, I shall argue, would replace paper computational instruments in sixteenth-century astronomy. As astrologers worked first to a precision of minutes, and after 1550 increasingly to a precision of seconds, paper instruments such as Stabius's simply could not provide the precision desired by the market. Although stunning visually, Stabius's prints lacked the mathematical horsepower that tables could provide. And since he did not publish instructions for two of the instruments, they might have been ignored additionally because later astrologers simply could not understand them.

Session 43

THE VISUAL CULTURE OF MEDICINE

Organizer: António Fernando Cascais

The Visual Culture of Medicine is a particular multidisciplinary and interdisciplinary field inside the broader domain of Visual Culture, that stems from both the theoretical and the practical coalescence and convergence between the Communication Sciences, including the Public Communication of Science, Science and Technology Studies, and particularly the History and Philosophy of Science and Medicine and the History and Philosophy of Technology, and Visual Studies, Aesthetics and the Arts. Any research programme on the Visual Culture of Medicine, as in the case of each and all the papers to be presented in this session, therefore positions itself at the intersection of Medical Science, Technology and the Visual Arts. The present session focuses specifically, but is not reduced to, the Visual Culture of Medicine in Portugal, exemplified in images and visual objects that have been retrieved, sampled, recorded and studied by the researchers and which results are patent in their papers in the session.

Session Title: The Visual Culture of Medicine

THE VISUAL CULTURE OF MEDICINE IN PORTUGAL

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Abstract

The present paper on the History of the Visual Culture of Medicine in Portugal is grounded on an innovative theoretical approach to the specimen images and visual objects of Medicine stored and exhibited in national museums, archives and libraries of Medicine. This theoretical approach is much indebted to the works of Erwin Panofsky, Marshall McLuhan, Michel Foucault and Paul Virilio. According to it, such images and visual objects can be ranked in three sequential, but partially overlapping, both historical and epistemic discrete stances. Each of them is defined, and distinguishable from the other ones, by the equation of one specific kind of technological medium that supports the medical image and its concomitant subtextual meaning expressed in an equally specific logics of the image or iconology. Those three historical periods or stances + media + logics of the image would thus be: 1) the age of the printed anatomical image, but that also includes the anatomical models in wood, ivory and wax, the skeletal preparations and the cadaveric embalmings, to which corresponds a formal iconology or logics of the image; 2) the age of photography and radiology, including chrono-photography and chrono-X-rays, to which corresponds a dialectical iconology or logics of the image; and 3) the age of digital imaging, including videography, holography and infography, to which corresponds a paradoxical iconology or logics of the image. The present paper will endeavour to give a clear account of each of the aforementioned three stances, by producing concrete examples of images and visual objects, by describing each kind of media as a meaning-productive technology and by defining each of the corresponding operative logics.

Session Title: The Visual Culture of Medicine

PROFESSOR DR. SILVA AMADO'S BOOKS OF AUTOPSIES,1902-1911

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Abstract

The autopsy reports that have been hand written between 1902 and 1911 by the then Professor of Legal Medicine and Hygiene, Dr. Silva Amado, have all been preserved and compiled in oversized books at the library of the Delegação Sul do Instituto Nacional de Medicina Legal e Ciências Forenses, I.P. Besides the medical-legal evaluations of each case, these reports also include detailed illustrations, *schemas* and photographic records. These medical illustrations fulfill the very specific practical and customary role of a legal record, but they also possess a genuine graphic quality and, above all, a certain intuitive value. Although they still aim to be as scientifically rigorous as possible, these illustrations have a rhythm of their own: an implicit expression of the urgency to come up with graphic descriptions of the cases. These records were held in high esteem by Professor Azevedo Neves, who succeeded Silva Amado, and whom we can consider the person responsible for the modernization and internationalization of the work developed by the then Lisbon Instituto de Medicina Legal. It is through the study of the material that has been compiled in the framework of the "History of the Visual Culture of Medicine in Portugal" (HC/0110/2009), under the guidance Professor António Fernando Cascais (CECL - FCSH-UNL), that we realize how these two medical personalities were involved with each other, on a historical but also on an aesthetical level of their scientific work, through both the insistence in the production of visual contents and the consolidation of such practices within the daily production of the medical-legal records. Medical illustration had a certain role on the scientific ideology of the visible, and through such a specificity, it also accomplished a legal truth about the body.

Session Title: The Visual Culture of Medicine

HYPER-REALITY IN WAX: ART, SCIENCE AND THE CLINICAL RECORDS OF SYPHILIS

Cristiana Bastos[a], Antonio Perestrelo de Matos[b]

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Abstract

While the development of technologies of representation influences the history visual cultures of medicine into the sequence drawing/photography/x-rays/digital, some "visual subcultures" have idiosyncratic chronologies. Ceroplastics, or wax modelling, provides a good example: tri-dimensional wax models of body parts as ex-votos and as graveyard artefacts precede anatomical drawings and paintings; dermatological moulages persist beyond the widespread of colour photographs and three-dimensional digital representations, as exemplified by the collections of Desterro and Capuchos, produced in Lisbon between 1933 and 1945 by an anonymous artist after lesions experienced by Portuguese patients, under the supervision of Dermatologists Sá Penela and Caeiro Carrasco. In this paper we will contextualize those collections and analyse the wax artefacts as works of art, products of science and clinical archives of shyphilis and dermatology.

Session Title: The Visual Culture of Medicine

THE VISUAL CULTURE OF STEREOSCOPY IN PORTUGAL: HAPTIC IMAGES AND THE HUMAN BODY

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Abstract

Contemporary visual culture is strongly investing in techniques and devices which expand the visuality beyond the purely optical experiences. The immersive environments of virtual reality the experiences with artificial sensitivity, particularly tactile, and with the tree dimensionality of images, are major stakes of the current visual industries to seduce the spectators, involving the participation of their bodies and subjective perceptions. One of the moments of the history of visual culture whose programme seems more related to this one was the moment of stereoscopic photography of the late nineteenth and early twenty centuries. With an approach grounded on the media archaeology studies (Huthamo and Parikka), under the major influence of Michel Foucault's work, the present paper will draw upon a sample of nineteenth century stereoscopic photographies representing human bodies (a few of them, nudes) that belong to some of the portuguese photographic steresocopic collections held by portuguese public museums and archives. Our goal is to understand the optical and tactile appeal of those images as constructed and mediated by this apparatus and the ways they influence our visual culture. We also aknowledge their value both as erotic and scientific experiences, specially regarding medical knowledge. Participating in popular culture, that soon developed an industry around this 'erotization' of the body, the kind of information these apparatus can convey was also influencing scientific thinking and imagination.

Session Title: The Visual Culture Of Medicine

THE RHETORIC ON STEREOSCOPY: THE DISCOURSES ABOUT STEREOSCOPY IN PORTUGUESE SPECIALIZED JOURNALS

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Abstract

The present paper aims to characterize the reception of stereoscopy in Portugal and how it was communicated to the professional and amateur photographers through the discourses published in several specialized journals on photography. These publications help us to recognize what were the proposed stereoscopy qualities and advantages, and to analyse the beliefs expressed on this 'new technique'. We'll present an analysis of the specialized journals on photography published in Portugal between 1869 and 1945 (respectively, the date of the first publication and approximate date of the last photographs). Unlike the more generalist publications, these journals were composed of articles on the photographic *medium*, its practices and progress. Their editorial currentness depended on frequent collaborations with foreign authors who fed the 'state of the art' of the journals and also their reflective vocation. The heuristic value of these publications is due to the fact that they don't restrict themselves to the condition of 'technical manuals' or to the 'lessons of photography' that characterized the vast majority of books in this period. They are, in fact, a privileged site for observing how this new technology was appropriated and announced to the early practitioners of photography. On the other hand, these publications are supported by advertising, particularly advertising from the 'world of photography' (studios, cameras and technical material), which enables the understanding of the role that *topoi* and rhetoric played as cultural discourses in these mediation strategies.

Session Title: The Visual Culture of Medicine

OBJECTIVITY AND STATISTICS IN THE CANCER ARCHIVE: AN EARLY 20TH CENTURY COLLECTION OF PATHOLOGY

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Abstract

This paper analyses the ways in which the early cancer collections of the Hospital of Santa Marta were organized in order to provide some of the material basis for medical research and education practices. By the turn of the 20th century, cancer studies were emerging throughout Europe under the impulse of the medical technological innovations of radioactive and X-rays therapies. In Portugal, cancer studies was being developed, since 1912, in one of the surgical clinics of the University Hospital of the new-born Lisbon faculty of medicine. As long as they were available, the novel therapeutic technologies were given clinical use either as complementary treatments of surgical procedures or as primary therapy, but always along with research motivations. As cancer patients were becoming more affluent, some of the clinical materials such as photographs, radiographs, surgical specimens, and microscopic preparations, were accumulating in the cabinets and laboratories of the clinic and calling for storaging and conservational management. Between 1915 and 1926 at the University Hospital of Santa Marta, thousands of visual items were assembled pretending to illustrate, in an objective stance, the pathological configurations of the masses. As these medical objects could be understood as embodying clinical experience they assumed their importance as pedagogic and research instruments, for which, in order to be swiftly retrieved from the body of the collections, they required an archival mode of organization. To achieve accessibility to all the different objects in a collection with such dimensions, the archive was set up in accordance to other visual archives of photographic content. Thereafter, making use of the disease classification conceived in the previous decades to provide international statistical comparison on the causes of death, the clinical archivists were able to preserve the individual character of each clinical case and, therefore, its clinical and pedagogic value.

Session 44

"PROVINCIAL" UNIVERSITIES, SCIENCE AND SCHOLARSHIP IN THE HABSBURG MONARCHY – REGIONAL EDUCATION CENTRES OR PERIPHERY OF STATE EDUCATION?

Organizers: Milada Sekyrková, Mitchell G. Ash, Attila Szilárd Tar

The symposium will deal with the position of universities outside Vienna within the education and science systems of the Habsburg Monarchy from 1770 to 1918.

The following questions will be considered:

- Can a political periphery be a scientific centre?
- Was remoteness from the Vienna centre a handicap, or rather an advantage due to greater autonomy?
- Which was stronger: collaboration or rivalry between the universities themselves, or between the University of Vienna and the other universities?
- Were there any interventions from the centre in the provinces, and if so, how did the provincial universities react? What was the impact of nationalistic tensions between the centre and the periphery?
- Did universities outside Vienna get involved in discussions about the system of education, introduction of national languages, nationalism and the like? Did they cooperate in resolving such issues, or did each act in its own interests, perhaps at others' cost?
- What modes or paths of communication between universities existed? Did communication always proceed through Vienna, or did it also take place by other routes?

Session TItle: "Provincial" Universities, Science and Scholarship in the Habsburg Monarchy – Regional Education Centres or Periphery of State Education?

ALMA MATER CAROLO-FERDINANDEA – ALMA MATER JAGELLONICA. MUTUAL INSPIRATIONS AND CONTACTS BETWEEN CZECH CHARLES-FERDINAND UNIVERSITY IN PRAGUE AND JAGIELLONIAN UNIVERSITY IN CRACOW 1882-1918.

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Abstract

When the Charles-Ferdinand University was divided into German and Czech parts in 1882, the Jagiellonian University in Cracow (together with the other Galician university in Lwow) became potential allies and inspirations for Prague professors, who bound their career with the Czech Charles-Ferdinand University. These men had to quickly establish the institution as the only Czech national university, ensure its material background and re-create its identity. Both Galician universities, where the teaching language was Polish since the 1860's, faced earlier similar tasks and problems. Moreover: the Jagiellonian University had the tradition of the oldest Polish university. There was a long history of contacts between Prague and Cracow since the mediaeval beginnings.These aspects were emphasized in formal contacts between both universities. The most significant example was the visible Czech participation in the celebrations of the 500th anniversary of the second foundation of the Jagiellonian University in 1900. The professors of Czech Charles-Ferdinand University, who took part in the celebrations (Jan Gebauer, Jaroslav Goll), mostly had real scientific and social contacts with their colleagues from Cracow. The paper will be focused especially on such working and partly non-official contacts.Several examples will be described to illustrate the above mentioned statements. The professor of Slavic Philology in Cracow Lucjan Malinowski (1839-1898) was permanently interested in the functioning of the Slavic Seminar at Prague University, which was directed by his colleague Jan Gebauer (1838-1907). Jaroslav Goll (1846-1929), the professor of

history in Prague, served as a mediator in this case. He had contacts with many personalities of Galician political and scientific life, e. g. the historian of law Michał Bobrzyński (1849-1936), later Austrian minister. Some of these contacts, which began as scientific, ended as political ones. There were further contacts in the fields of anthropology (Julian Talko-Hryncewicz, Lubor Niederle, Jindřich Matiegka) or law (Stanisław Kutrzeba, Karel Kadlec), which influenced the appearance of the relevant departments at universities. The form or even the existence of a department at one university was sometimes used as an argument for the Viennese ministries to create or accept a similar situation at the other university.The paper will focus also on the role of learned societies in the development of contacts between universities and vice versa. In the late 19th and early 20th centuries professors of both universities presented the most influential members of national academies of sciences – Academy of Arts and Sciences in Cracow (Akademia Umiejętności w Krakowie, founded in 1873) and the Czech Academy of Arts and Sciences (Česká akademie věd a umění, founded in 1891). Before 1918 mostly the same personalities were active in the contacts between both academies and universities.

Session TItle: "Provincial" Universities, Science and Scholarship in the Habsburg Monarchy – Regional Education Centres or Periphery of State Education?

AN EARLY NETWORK OF UNIVERSITIES IN THE HABSBURG MONARCHY: THE BEGINNINGS OF THE CONFERENCE OF AUSTRIAN UNIVERSITY RECTORS FROM THE 1890S TO 1918.

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Abstract

Today, „Universities Austria", the „Österreichische Universitätenkonferenz", is the common voice of Austrian public universities. The beginnings of this instiution go back to the time of the Habsburg Monarchy. At least since the late 19th Century, it was not unusual that University Rectors in the Habsburg Monarchy, especially its Cisleithanian part, consulted one another sometimes on an informal basis on subjects of common interest. But the first attempts to give a more formal structure to these consultations date only from the last decade of the century, and it was the technical universities that took the lead.

In 1894, the Rector of the Vienna Technische Hochschule, Franz Toula, invited his fellows from the other Austrian Technische Hochschulen to a conference in Vienna to discuss mainly questions of professional status and remuneration schemes of professors. A few years later, universities in Germany started similar initiatives, and during the next few years, there were several conferences of German universities, or even universities of German speaking countries, including guests fron Austria and Switzerland.

In 1910, it was again a Rector of the Vienna Technische Hochschule, Hans Jüptner von Jonstorff, who proposed a conference of the Rectors of all Austrian institutions of higher education, universities as well as Technische Hochschulen, to discuss common problems. He succeeded in convening a first conference in 1911, but it took more

years and many more discussions to stabilize these conferences on a more or less regular basis. During these discussions, internal conflicts, especially between the University of Vienna and the „Provincial“ Universities, but also differences between Universities and Technische Hochschulen became visible. The endemic national tensions of the late Habsburg Monarchy also played a certain role. Nonetheless, several meetings of the „Rectors‘ Conference“ (Rektorenkonferenz), and in addition some separate meetings of the Rectors of the Technische Hochschulen took place before the end of World War I.

The proposed paper will analyze the subjects discussed during these conferences, and the views held by the representatives of the different types of institutions. The main questions will be: how far did the „Rektorenkonferenz“ function as a representation of the general interests of the Austrian Universities (or their professors) viz-a-viz the Ministry of Education, and to what degree did the tensions between „centre“ and „periphery“ and between the nationalities (especially „German“ vs. „non-German“) influence the discussions and their outcome?

Session TItle: "Provincial" Universities, Science and Scholarship in the Habsburg Monarchy – Regional Education Centres or Periphery of State Education?

COMMUNICATING POLITICS IN THE DISSECTING ROOM: THE INFLUENCE OF BOHEMIAN STUDENTS AND PHYSICIANS ON THE LIBERAL MODEL OF HUMAN PROGRESS AT THE UNIVERSITY OF VIENNA.

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Abstract

In the first half of the 19th century, universities in the Habsburg Monarchy were not a place of free academic communication, but institutions supervised by the government and patronized by the state. Disciplinary consequences followed when a student or professor tried to oppose official orders. The philosopher Bernard Bolzano, professor at the University of Prague, had to leave because he had incited social-reformist and liberal ideas among students. Medical students, who first had to complete a philosophical preparatory course, had been impressed by Bolzano and carried on his ideas. Disappointed with the low level of most of the lectures at the Medical Faculty, quite a few of them left Prague for Vienna. For those who wished to achieve social mobility, study and an academic career at the Medical Faculty of the University of Vienna was regarded as high credit. Due to poor prospects in Bohemia or Moravia, these students and young physicians developed an increasingly strong oppositional attitude against the authoritarian government. The more political engagement was banned in the "pre-March" period, the more fiercely physicians engaged in campaigns for reforms in medicine. The Prague Community of liberal physicians in Vienna was mainly responsible for the Doctors' Revolution of 1848, prepared in the dissecting rooms of the Medical Faculty, where political discussions could take place without state control. Liberalism was built on scientific thinking. Vienna nonetheless understood how to take full advantage of the intellectual capital from Prague, which helped to found the Second Viennese Medical School. The Medical Faculties of Vienna and Prague were important partners in scientific cooperation within the

Habsburg Monarchy. Medical professors, trained in Vienna, taught at the University of Prague and Prague sent its outstanding medical professors to Vienna. However, to what extent the Habsburg Monarchy valued this think-tank, or whether they regarded it as a future threat, has not yet been fully researched.

This paper seeks to discover the influence of the social environment and study conditions at the Medical Faculty of Prague on the development of scientific orientated medicine and liberal reforms at the Medical Faculty of Vienna. The different images of both these Medical Faculties, described by their students and medical professors, will be demonstrated by information taken from letters, the most important communication instrument at this time.

Session TItle: "Provincial" Universities, Science and Scholarship in the Habsburg Monarchy – Regional Education Centres or Periphery of State Education?

ABSOLUTE LOYALTY OR THE CALM BEFORE THE STORM? SOME EVENTS AT THE PRAGUE UNIVERSITY IN THE FIRST HALF OF THE 19TH CENTURY.

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Abstract

In terms of the position of universities in the Habsburg monarchy, historiography usually views the first half of the 19th century as a period of absolute state control, lack of freedom of scientific investigation, and suppression of any expression of free opinion in teaching. Was this situation in reality uncomfortable for the teachers? Did they want the freedom to act, or did they prefer to obey the dictates of Vienna?

In the given period, two faculties were significant among four faculties of the Charles-Ferdinand University: the Faculty of Arts and the Faculty of Medicine. Can we consider the Faculty of Arts merely a preparatory for studies at the other three faculties? Was its staff just an obedient executor of Vienna´s decisions and its blind advocate after the departure of Bernard Bolzano?

The Faculty of Medicine is considered as one with relatively free development of scientific research in the first half of the 19th century. In what ways were new ideas and knowledge coming from abroad and other parts of the Monarchy appropriated at the Faculty? What negotiations of the teaching staff took place in this respect? To answer these questions, the paper will focus mainly on the debates of professorial staff of the philosophical and medical faculties regarding the various curricular decrees and regulations coming from Vienna. It will analyze the staff´s position as well as the opinions of individual professors, and consider their loyalty versus attempts to introduce independent views and modify (where possible) the regulations. The paper will be based on an analysis of procedural protocols of the professorial staffs of the Faculty of Arts and the Faculty of Medicine of the Prague University in the 1820s and 1830s of the 19th century.

Session TItle: "Provincial" Universities, Science and Scholarship in the Habsburg Monarchy – Regional Education Centres or Periphery of State Education?

SLOVENE INTELLECTUALS BETWEEN ACADEMIC CAREERS AND NATIONAL CAMP'S EXPECTATIONS IN THE HABSBURG MONARCHY.

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Abstract

Although Slovenian nationalists in the period of the Habsburg Monarchy were constantly striving for the establishment of a Slovenian university, this was not realized before 1919. Slovene-speaking students therefore studied mostly at Austrian universities (by far the most studied in Vienna and Graz, some also in Prague and in other university towns).

The subject of our research will be the description of these configurations, meaning the graphical representation of the number of Slovenian students at individual Austrian universities for the period from the second half of the 19th century until the First World War. This will be followed (mainly through a biographical method) by the analysis of the complex and ambivalent relationships between students and scientists of Slovenian descent, whose main professional goal was to successfully function in the academic field, and the Slovenian nationalists, whose long-term goal was to form the Slovenian national identity and the Slovenian nation.

Slovene-speaking students and scholars often functioned as important carriers of cultural transfer from "the centre to the periphery", that is from more developed urban centres (campuses), in particular Vienna, to an under-developed homeland that was not completely ethnically homogeneous. But their role was not always supported and understood, because parents were afraid of their children jeopardizing their career with some kind of (political) campaign, and because opinion-makers saw in them

possible propagandists for opposing ideological ideas. At the same time they were occasionally criticized for their lukewarm attitude towards the national question.

In the context of this analysis of friction between Slovenian nationalists and Slovenian students and intellectuals, we will ask the following questions: How did Slovenian intellectuals who had returned to their homeland (the periphery), maintain (intellectual) contact with university centres (the centre)? What knowledge and ideas did they (successfully) transfer to the Slovenian environment, and did they encounter resistance? Why did some intellectuals of Slovenian descent who had made successful academic careers fail to persevere in their efforts within the Slovenian national camp? Was this, for example, the result of different affinities, of the politicians' fear of competitors, or was this a result of conceptual and ideological differences, specifically of the intolerance of nationalists who could not accept and make sense of the role of intellectuals, at least to an extent that would have satisfied both parties? Or was it the opposite, a spontaneous development of intellectual networks that were leaving the Slovenian territory on the periphery, that is of career/research interests of Slovenian scientists who were looking for colleagues beyond national borders, if necessary even in a nationally competitive environment? We will try to find the answers to these questions through the biographical method, working with a selected sample of Slovenian students and scientists.

Session TItle: "Provincial" Universities, Science and Scholarship in the Habsburg Monarchy – Regional Education Centres or Periphery of State Education?

TURNING "PROVINCE" TO A "CENTRE"? AMBITIONS TO ESTABLISH INSTITUTIONALIZED NETWORK OF SLAVIC SCIENTISTS AT THE TURN OF THE 19TH CENTURY.

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Abstract

In the last two decades of the 19th century, the Czech scientific community had gradually established a linguistically Czech institutional and communication base, namely universities, scientific and learned societies and journals, and became a self-assured minority within the Habsburg Monarchy. Supported by economically and politically strong strata of the Czech population, Czech academics, especially chemists and physicians, even attempted to establish their own autonomous representation on the international scene. Encouraged by these accomplishments, the Czech scientific community made serious efforts to strengthen its position not only within the Austro-Hungarian Monarchy, but also outside its territory. One instrument of this endeavour consisted in bringing together Slavic scientists with a vision of establishing a Slavic scientific community around a new centre – Prague. The programme of Slavic scientific cooperation, which took shape especially during the Prague congresses of Czech naturalists and physicians from 1880 to1914, included establishing Slavic scientific journals, creating common Slavic scientific nomenclature, publishing terminological dictionaries and Slavic bibliographies, organizing regular Slavic congresses, founding Slavic scientific societies, exchanging Slavic students, etc. In these efforts Czechs (especially the chemists and physicians), played the role of a hegemon motivated by both scientific and political goals. Although this extensive programme of Slavic scientific integration never materialized, we may discuss it as a historical attempt at integrating the periphery and creating a new centre, in this case of "Slavic science". The effort to launch an institutionalized cooperation of Slavic scientists can also be considered a special case of the nationalization of scientific knowledge as treated recently in the monograph edited by M. Ash and J. Surman.[1]

[1] Ash, MG, Surman, J (eds.), *The Nationalization of Scientific Knowledge in the Habsburg Empire (1848 - 1918).* Basingstoke: Palgrave Macmillan 2012.

Session TItle: "Provincial" Universities, Science and Scholarship in the Habsburg Monarchy – Regional Education Centres or Periphery of State Education?

GATHERING EXPERIENCE ABROAD. THE STUDY-TOURS OF STUDENTS AND TEACHERS FROM THE TECHNICAL UNIVERSITY OF BUDAPEST 1899-1914

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Abstract

The Technical University of Budapest was a young institution at the end of the 19th century. It was founded in 1871, though it had some forerunners from the 1840s. The Hungarian technical schools tried to copy the German model. To do this they needed information about this type of higher education. It is possible to detect several modes of information-collection, which can be seen as forms of communication.

For example, the Technical University of Budapest asked the German Technical Colleges and universities about different matters in letters. Another form of communication was the arranging of excursions to partner institutions. Thirdly we can mention doctor "honoris causa" awards, as well as memberships of Hungarian professors in German scientific academies or societies. A fifth form of connection consisted of study tours of students and teachers to German institutions.

In this presentation I aim to analyse these visits of Hungarian students and professors from the Technical University of Budapest to European destinations for the purpose of gaining experience. It was a good period for such visits: the Hungarian government supported these part-time studies and the study-tours of Hungarian students and professors abroad. These studies usually involved visiting factories, public institutions and scientific institutes. The students of the Technical University in Budapest participated actively in these projects.

The documents in the archives list 17 people who were sent abroad during the above mentioned period, and in addition one teacher was sent three times within 15 years. The link between them is that they visited some colleges, conferences and also

factories or modern technical achievements. The main destination of these tours was Germany, sometimes as part of a wider Central-European journey. The participants applied for a scholarships, which were usually granted by the Ministry for Education and Religion.

In my presentation I will examine the procedure of applying for scholarships, the rules for receiving funding, and the final reports about these study visits, as well as the resulting benefits for Hungarian industry and transportation.

Session 45

PAULING'S « NATURE OF CHEMICAL BOND » IN POST WWII CHEMICAL CURRICULA : EUROPE AND BEYOND

Organizers: Brigitte Van, Danielle Fauque, Gisela Boeck, Annette Lykknes

The American chemist Linus Pauling began investigating the forces that held together atoms to form molecules using quantum physics in a series of articles published between 1931 and 1933. His quantum mechanical approach was further developed and later disseminated through his ground-breaking textbook "The Nature of the Chemical Bond" published in 1939, soon to be followed by a second revised edition in 1940. Considered a milestone in theoretical chemistry in the late 1940s already, its circulation in Europe was however hindered by World War II and the subsequent partition of the Old Continent in two blocks that added to the natural inertia of scientific curriculum to novelty. As a consequence, in some places it could take a generation before the implications of this new approach was fully incorporated into the scientific and teaching communities.

This session aspires to explore how the appropriation developed, and how local cultures of chemistry and indigenous teaching policies and traditions adapted the main principles of Pauling´s quantum approach to chemical bond to their chemistry curricula at the higher education level, including continuing education. The contributions explore different aspects of the incorporation of Pauling's ideas, among other things the circumstances of the translation and the use in textbooks and teaching of the "The Nature of the Chemical Bond", and the "General Chemistry", as well and studies of the impact of personal contacts.

Papers will be kept short as to allow ample time for the commentators to comment on the different case studies and trigger an open discussion.

Organizers :

The Initial Reception in France of The Nature of the Chemical Bond

Pierre Laszlo

'The Nature of the Chemical bond' and its reception in the chemical education in the GDR

Gisela Boeck

Footnotes to the first Italian translation of Pauling: a curious history

Marco Taddia

Impact of Linus Pauling's ideas on the activity of the Brasilian Professor Ricardo Ferreira

G.M. Silva, L. Degrève, F.C.F.F. Sousa

Commentator and chair

Chair : Danielle Fauque
Comments : Ana Simoes and Kostas Gavroglu

Please send the file, with the abstracts, to us (occoe@occoe.pt) under the name <**ESHS2014_Session_presenter.doc**>

Session Title: Pauling's "Nature of Chemical Bond" in Post WWII European Chemical Curricula

'THE NATURE OF THE CHEMICAL BOND' AND ITS RECEPTION IN THE CHEMICAL EDUCATION IN THE GDR

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Linus Pauling is well-known to chemists who studied in the GDR. His theory of the chemical bond inspired several generations of chemists. In the 1960´s Pauling´s name could be found in school textbooks and his theory at a reduced level was taught in gymnasiums.

This paper will demonstrate the influence of Pauling´s theories on the chemical bond in the eastern part of Germany. In GDR time the acquisition of literature from western countries was difficult. Participation on conferences, internships and personal contacts were limited. The paper presents the equipment of some GDR libraries with Pauling´s fundamental books. It will be discussed if and in which manner the theory was reflected in GDR textbooks. A survey of translated books on the chemical bond from the Soviet Union will be presented.

Most GDR professors of Inorganic Chemistry knew Pauling´s concept from different sources. For example, Günther Schott (1921-1985), educated in chemistry in Leipzig and later professor of Inorganic Chemistry in Rostock, was one of the first teachers who not only knew, but also taught the chemical theory on valency on the quantum chemical fundament. And most important, he was able to teach it in an understandable way. Later he contributed to a textbook and enforced the integration of the theory of the chemical bond into teaching.

These examples illustrate the way of knowledge from the western to the eastern block in the case of the nature of the chemical bond.

Session Title: Pauling's "Nature of Chemical Bond" in Post WWII European Chemical Curricula

THE INITIAL RECEPTION IN FRANCE OF *THE NATURE OF THE CHEMICAL BOND*

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During World War II, in Occupied France, with hostile Vichy propaganda towards Anglo-American influences, *The Nature of the Chemical Bond* was virtually unknown to French chemists. The Pullmans, at the *Institut de biologie physico-chimique* (Rothschild Foundation) treasured their copy, in microfilm form. With very few exceptions — such as Marc Tiffeneau, and his co-worker Bianka Tchoubar — professors of chemistry at the Sorbonne, Collège de France and at other institutions of higher education, were uninterested. They felt threatened by the new ideas and preferred the status-quo.

A French translation was brought out in 1949, not at their urging, by the *Comité pour l'expansion du livre scientifique*, within the *Union Française* movement, led by the elderly Paul Gaultier (1872-1960), of the *Académie des sciences morales et politiques* — not of the *Académie des sciences*. This committee published Pauling's book as science popularization, to document the new physical and chemical theories and to bolster philosophical inquiry.

A professor at the Sorbonne was nevertheless active in promoting Pauling's ideas. He was not teaching chemistry. In so doing, he bypassed his colleagues in chemistry. This was Gaston Bachelard, who held the chair of history of science. His 1953 book, *Le matérialisme rationnel*, summarized Pauling's valence-bond theory, as applied to aromatic molecules. It did much to introduce Pauling's chemical bond theory in France, beyond the narrow circles of philosophers and a few physical chemists.

Pauling's ideas were thus introduced to French education piggy-backing on philosophical discussions. This presentation will put the appearance of *La nature de la liaison chimique* in its Cold War context : the influence of the Communist Party on the French intellectual class, the hostility in the USSR to Pauling's theory and the countervailing NATO-led diffusion of American culture in Western Europe.

Session Title: Pauling's "Nature of Chemical Bond" in Post WWII European Chemical Curricula

IMPACT OF THE LINUS PAULING IDEAS ON THE ACTIVITY OF THE BRASILIAN PROFESSOR RICARDO FERREIRA

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At the age of 17, Ricardo Ferreira (1928–2013) first heard about Linus Pauling in chemistry classes in his third year of college in Recife. That same year, he acquired *The Nature of the Chemical Bond* and was fascinated by Pauling's ideas. When Ferreira started the undergraduate chemistry course at the *Universidade de São Paulo* in 1949, he was disappointed because he expected to find teaching that already incorporated these ideas. As a result, he moved to the *Universidade Católica de Pernambuco* where he completed his studies. During this period, he corresponded with Pauling and founded, along with Professor Ernesto Silva (1900–1970), the *Centro de Estudos Linus Pauling* at the *Faculdade de Farmácia de Recife*. Influenced by the ideas of Pauling, Ferreira and Silva wrote *Introdução ao Estudo da Química Geral e Inorgânica* in 1953. In the 1959 edition of this book, they included a quote from Pauling regarding "how chemistry should be learned". His admiration for Pauling led Ferreira to want to work with him at Caltech with a Rockefeller Foundation grant. However, the collaboration was not possible due to the retaliation suffered by Pauling at the university because of its pacifist position regarding the atomic bomb. However, Pauling invited Ferreira to attend his courses on the physical nature of chemical bonds and general chemistry. Through discussions held with Pauling, Ferreira published three articles of theoretical chemistry in *Nature* and in the *Transactions of the Faraday Society*. Furthermore, Pauling agreed to write an article for a special issue of the journal *Química Nova* in 1988, which was dedicated to Ferreira. Throughout his academic career, Ferreira sought to apply the ideas of Pauling in chemistry teaching in colleges and in Brazilian, European, and American universities. In research, he formed more than 20 researchers and wrote more than 120 articles and books in the areas of chemistry and biophysics.

Session Title: Pauling's "Nature of Chemical Bond" in Post WWII European Chemical Curricula

FOOTNOTES TO THE FIRST ITALIAN TRANSLATION OF PAULING: A CURIOUS HISTORY

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The first translation of "The Nature of the Chemical Bond" into Italian was published in 1949. Dr. Eugenio Mariani (1912 –2005) who translated the second American edition began the work long before and printing started in 1945. Such a significant delay was mentioned by the translator in opening remarks and ascribed to publisher's vicissitudes. The WWII came to an end on April 1945 and Italy emerged slowly out of the ruins of war. It is obvious that the post-conflict reconstruction was hard time for publishing companies. In addition, the publisher Calogero Tumminelli (1886-1945) died the same year and was succeeded by his son Roberto (1913-1982). The book's foreword was written by Giovanni Battista Bonino (1899-1985), one of the most influential scientists of his days. Bonino obtained in 1927 the chair of Physical Chemistry at the University of Bologna. Dr. Mariani, a Bonino's disciple, graduated in 1935. He was appointed professor of Industrial Chemistry in 1951. The Italian version of Pauling's book is characterized by a lot of translator's footnotes showing the contributions of Bonino's school to the various topics. The disappearance of such notes in the 2nd Italian edition (1961) is more than an editorial curiosity. The paper aims to enlighten an episode in the history of Italian chemistry that has not duly considered. A recently acquired letter of Bonino to Pauling dated May 31, 1949 will be presented.

Karachalios A. (2001), *I chimici di fronte al fascismo. Il caso di Giovanni Battista Bonino (1899-1985),* Istituto Gramsci Siciliano, Palermo

Karachalios A. (2005), *Tradizione e modernità: la fondazione quantomeccanica della chimica organica, 1927-1945*, Atti del XI Convegno Nazionale di Storia e Fondamenti della Chimica, p. 211

Session 46

MEDICINE, EMPIRE AND PUBLIC HEALTH (XIXth AND XXth CENTURIES): NETWORKS IN METROPOLITAN AND COLONIAL SPACES

Organizers: Isabel Maria Amaral, Ana Cristina Roque, Inês de Ornellas e Castro, Philip Havik

This panel invites scholars to reflect on the role of medicine in the establishment of transnational professional networks during the nineteenth and twentieth centuries. It intends to build and expand upon the ongoing debate regarding the study of medicine and empire which emerged the social sciences in the late 1980's.

Studies on the role of bio- and tropical medicine in empire have focused above all on the relations between the metropolitan centre and colonial peripheries. They have demonstrated the importance of medical science in establishing public health systems in the context of a broader momentum towards colonial modernity. The emergence of colonial medicine in the 1800s and the affirmation of tropical medicine in the early 1900s contributed to the production of knowledge and innovations in terms of preventive and curative medicine. International bodies such as League of Nations and the UN accelerated the exchange and circulation of information on disease environments, vectors, new drugs and treatments. The subsequent internationalization of bio-medicine led to the proliferation of intra-colonial and transnational networks geared towards the combat of endemic diseases in metropolitan and colonial settings.

However, the complexity of relations between metropole and colony justifies a closer look at how medical knowledge and which knowledge circulated; how - and whether - it was actually applied in colonial practice; and to what extent it was exchanged within the colonial periphery itself. In addition, it is crucial to understand the way in which knowledge and practice changed as it travelled within empires and beyond imperial frontiers, and in which way it was integrated - or not - into metropolitan and colonial public health systems. Last but not least, a focus on networks should also take into account the role of local actors - medical and non-medical personnel - in shaping these networks and the production and dissemination of information transmitted through them.

The panel's proponents wish to invite scholars from the natural-, life- and social sciences to submit proposals for papers in order to engage in a fruitful discussion on the nature and role of medical knowledge, and its intercultural, multilingual and transnational dimensions.

Session Title: Medicine, Hygiene and Public Health (XIXth and XXth Centuries): Networks in Metropolitan and Colonial Space

BRIDGES FOR INTERNATIONALISATION OF PORTUGUESE TROPICAL MEDICINE: FROM RICARDO JORGE AT NATIONS LEAGUE TO FRANCISCO CAMBOURNAC AT WHO

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Abstract

The institutionalization of the Portuguese tropical medicine emerges with the foundation of the School of Tropical Medicine of Lisbon, in 1902, three years after the pioneering institutions established in the UK , intercepting the scientific with the political agendas, in the context of European imperialism. The long life of the Portuguese tropical medicine and its institutions (for more than a century) is the result of their inclusion in international networks of medical knowledge (scientific and medical meetings, medical missions, League of Nations and World Health Organization) in which stand out as the main actors, Ayres Kopke (1866-1947) and Francisco Cambournac (1903-1994).

The route for the establishment of this medical specialty (tropical medicine) have its origins in the early reforms of hygiene and public health led by Ricardo Jorge, integrated into the Pasteurian concept of disease.

This article aims to analyze the impacts on the institutionalization and consolidation of the Portuguese tropical medicine from the contributions of a reduced set of actors, from Ricardo Jorge Francisco Cambournac, inside the dichotomous matrix center/ periphery, for the construction of a new area of medical knowledge at the interface of tropical diseases and the building of the Empire.

Session Title: Medicine, Hygiene and Public Health (XIXth and XXth Centuries): Networks in Metropolitan and Colonial Space

METROPOLITAN AND COLONIAL REPORTS: CONTRASTING & SHIFTING PERSPECTIVES ON MEDICINE & PUBLIC HEALTH CARE IN FORMER PORTUGUESE AFRICA

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In recent years, research on Portugal's former colonies has begun to produce some promising results with regard to colonial health services and their provision of care to indigenous populations. This emerging thread is associated on the one hand with a greater focus on intra-colonial administration of health in these territories and on colonial and international medical networks on the other. Both have demonstrated the benefits of multi-disciplinary approaches (i.e. social & economic history, medical anthropology, history of science, tropical medicine, demography, etc). They form part of a broader focus on the trajectories of bio-medical knowledge 'in the tropics' that has provided new insights into issues related to health and empire, i.e. on the 'microbiological revolution' and its impact in a colonial context, on the production and circulation of medical knowledge within empire, and on the different actors and professional networks involved in colonial sanitation and hygiene. Much of this research is based on an understanding of 'colonial science' as a 'tool' that responded to strategies of surveillance and control over the health of native communities in order to guarantee a regular supply of labour, crops and taxes.

The case of the former Portuguese colonies in Africa appears to contradict much of this perspective, owing to a marked discontinuity of policies and ad-hoc practice, as well the existence of distinct, overlapping discourses based upon 'colonial' and 'tropical' medicine. The re-founding of colonial health services after the military campaigns in the early 1900s and the arrival of tropical medical specialists over the next decades was to introduce new perspectives on endemic diseases and campaigns to combat them but did not necessarily contribute to a better understanding of indigenous health. From the 1930s onwards, reports on Angola, Mozambique and Guinea provide vivid accounts and a strong worded critique of the inadequacies of health services, on account of a lack of infrastructures, staff and chronic underfunding. The integration of these colonies into multilateral institutions and international medical networks geared to the combat of certain endemic diseases, especially after WWII, would however bring significant changes. The present paper discusses the impact of these international dimensions in terms of public health and the different networks that sustained these changes both in metropolitan Portugal and its colonies.

Session Title: Medicine, Hygiene and Public Health (XIXth and XXth Centuries): Networks in Metropolitan and Colonial Space

HERBAL MEDICINES *VERSUS* DRUGS: DISEASE AND HEALING IN MOZAMBIQUE IN LATE XIXTH CENTURY

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Abstract

In the last quarter of the 19th century, the implementation and performance of the Health Services in Mozambique comes to witness the gap between an accumulated knowledge on the use of local herbal medicines, and a mode of operation that insists on imposing Western values and models that seem to ignore it.

Disease and cure, diagnosis and treatment were still unsolved problems, persisting disparate approaches and methodologies that revealed different types of learning and "scientificity", diverse concepts and practices backed up in different networks of knowledge.

The reports of the local Directorates of the Health Services come attest to this confrontation when reporting local healing procedures and methods in a regional framework whose detailed description also refers to a broad knowledge of the specific conditions and potential medicinal resources of the various districts.

While trying to implement western models and new methodologies to treat the most relevant tropical diseases and to solve basic problems related to poor sanitation and hygiene, those responsible for the Health Services' reports, could not fail to describe some of the possible local alternatives to the western drugs that occasionally revealed themselves far more effective in the treating of some local diseases. Therefore, these reports are primary documentary sources not only for the history of the tropical medicine and the implementation of the Portuguese colonialism in Mozambique but also for the study on traditional indigenous knowledge related to the local phytotherapeutic practices and the possible epistemic cultural exchanges between European and non-European medical practices.

In this respect, this paper will discuss the importance and role of these reports in the colonial medical discourse and practice.

Session Title: Medicine, Hygiene and Public Health (XIXth and XXth Centuries): Networks in Metropolitan and Colonial Space

MEDICINE IN A BESIEGED COLONIAL SETTING: GOAN DOCTORS AND THE TIDES OF HISTORY

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This paper explores the changing conditions of the practice of medicine in Portuguese India, between 1945 and 1961, a timeframe which encompasses the changes brought about by the end of the Second World War through to the end of Portuguese rule over Goa, Daman and Diu, on the West coast of India.

Drawing from the historical dynamics of medicine in Portuguese India, recently problematized by historians and anthropologists, this paper explores the challenges faced by Goan doctors in their practice of an increasingly internationalized and specialized "scientific medicine". It shows that Goan doctors were part of the ever more tense political context in Portuguese India, which conditioned their participation in an expanding international network where the World Health Organization (WHO), officially established in 1948, and its regional offices played an important role. The WHO not only endeavoured to bring together conflicting interests in health planning and interventions, but also to promote the training of national clinicians and medical experts that would bring to effect the strategies agreed upon at the Health Organization.

Considering the international and local circumstances, this paper will examine Goan doctors' skills in appropriating international medical models and strategies to Portuguese India's context; and their seizure of the selective opportunities given by the WHO. It will show that under Portuguese India's political circumstances, logics of power, interest and perceived needs, the international/global models of medical science and practice were cautiously selected and adapted.

Session Title: Controversies and Debate

FROM SEEDS TO CROPS: CONTROVERSIES ON GENETICAL IMPROVEMENT AND AGRICULTURAL DEVELOPMENT IN MEXICO, 1920-1961

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Abstract

World agriculture was deeply transformed in the first half of the twentieth century. Among others, the rediscovery of Mendel and the development of fitogenetics, allowed the possibility of modeling species of economical interest to adapt them to the growing agribusiness sector: resistant plants to agrochemicals, adapted to agro machinery, and to the food processing industry, and so forth.

In the maize case, it was a complex and controversial process. In Mexico the introduction of hybrid seeds and technologies with the inputs associated with them by the Rockefeller Foundation in the 1940s, generated interesting discussions about the political, economic and environmental risks associated with this plant breeding and agricultural development model. In this sense, maize seeds were *actants* that, depending on its configuration (like seed or crop), framed different narratives and agricultural development horizons.

In our communication we would like to identified and analyze the controversies through the different trajectories followed by the seeds. To assume they as *actants* (seeds or crops), allow us to question and observe their itineraries and the different horizons shaped, in order to show the different rationalities and models that existed on plant breeding, and to show the awareness existing at this time about the implications of the different agricultural development models in the first half of the twentieth century in Mexico.

Session Title: Controversies and Debate

FAILED DIALOGUE BETWEEN TWO COMMUNITIES: MATHEMATICIANS AND PHILOSOPHERS ON DETERMINISM AROUND 1880

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Abstract

The second half of the nineteenth century was the stage for a meaningful transformation in the field of natural sciences. The professionalization of physics, chemistry, earth sciences, and life sciences was accompanied by the emergence of new theories and new practices. Methods and specific contents of science assumed philosophical relevance, and science took the lead: meaningful philosophical issues spontaneously emerged from scientific theories and scientific practice. In the debates on science which took place in France from the late 1870s to the early 1890s two main issues were at stake: determinism and reductionism.

Some mathematicians and engineers began to discuss the scientific and philosophical consequences of extremely specific features of mathematical procedures. According to Joseph Boussinesq and Adhémar Barré de Saint-Venant, some bifurcation in the solutions of differential equations cast doubt on the strict determinism that was explicitly or implicitly assumed to rule natural processes.

The relationship between mathematical physics and life sciences, and the relationship between mathematical physics and free will, attracted the attention of philosophers after having raised some debate in the scientific context. Obviously, philosophers made use of words and concepts very different from the words and concepts which belonged to the tradition of mathematics and mathematical physics. If Boussinesq, Barré de Saint-Venant, Bertrand, Duhemal, Cournot, … had spoken of “singular solutions” of differential equations, bifurcations, and determinism in connection with specific problems which stemmed from a specific field of mathematics, the philosophers widened the scope of the debate, and focused on very general themes.

During the XIX century, the language of philosophers had become quite different from the language of scientists, and the communication between the two bodies of knowledge and the corresponding communities was becoming ever more problematic.

Session Title: Controversies and Debate

DARWIN'S TIME OF TRANSMUTATION: CRAFTING ARGUMENTS ABOUT THE INCONCEIVABLE.

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Charles Darwin required immense periods of time within which the transformist consequences of his primary evolutionary mechanism of natural selection could be traced, but he also needed a working time within which selective processes could operate. The former, "deep" time functioned according to different rules from those of ordinary, "shallow" time. The experience of the naturalist occupied the particular slice of shallow time that constituted the present; it was from that experience that Darwin necessarily had to build his arguments concerning a transformism that took place on an entirely different temporal scale. While Darwin argued for the existence of selective processes themselves in contemporary, and effectively synchronic, shallow time, their transformist consequences could only be traced out in diachronic deep time, being evidenced by both contemporary and paleontological slices, or synchronic laminae, of shallow time. The present was merely the upper or most recent slice of those integrated laminae. This metaphysics of time followed from the argumentative practices by which Darwin attemoted to solve his forensic problems.

Session Title: Controversies and Debate

USE AND ABUSE OF *PRISCA MEDICINA*: PETRUS SEVERINUS (1571) VS ANDREAS LIBAVIUS (1599)

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Focused on early modern alchemy and medicine, this paper examines the common alchemical rhetoric of two intellectually divergent authors: Danish physician Peder Sørensen or Severinus (1540-1602) and German physician Andreas Libau or Libavius (1555-1616). Both chymists received a medical education in European universities, where they were trained in Aristotelian and Galenic natural philosophy. Expressing a major interest in alchemy, they are both known in the historiography of early modern science for their contribution to the diffusion of alchemical ideas in the late Renaissance. On the one hand, Severinus's *Idea medicinae philosophicae fundamenta* (Basel, 1571) is a seminal treatise for the circulation of Paracelsian iatrochemistry in the early modern period. On the other hand, Libavius's medical treatises, such as *De novus medicina veterum tam Hippocratica quam Hermetica tractatus* (Frankfurt, 1599), are characterized by an anti-Paracelsian polemical tone, in the context of the academic controversy between Galenists and Paracelsians. Based on previous studies on Severinus and Libavius, respectively by Jole Shakelford (2004) and Bruce Moran (2007), this paper will survey the common rhetorical strategy of both chymists, intending to discredit the rival philosophy and support the recovery of a *prisca medicina*. Indeed, Severinus and Libavius resorted to the ideal of a primordial medical wisdom connected to chymical knowledge, and then spoiled by the mistakes of confused "modern" physicians. Both authors integrated this chymical topos into their antithetic appraisal of ancient and medieval debates on the ultimate constituents of the living body. First, the paper will compare their respective account of the genealogy and circumstances of the *prisca medicina*, rooted in ancient Greek and Arabic culture. Second, it will explore their particular criticism of the concurrent medical philosophy, as related to the Aristotelian four elements, the Galenic qualities, and the Paracelsian *tria prima* within the human body.

Session Title: Letters and Networks

TRAVELLING KNOWLEDGE: CORRESPONDENCE BETWEEN SCIENTISTS AND THE DEVELOPMENT OF CATALAN MOLECULAR BIOLOGY

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Until the universal use of electronic mail, letters were the most common way by which scientists communicated informally and formally between them. These letters have acted as messengers and custodians of initiatives, projects, achievements and scientific debates. This epistolary exchange created authentic networks of scientific communication among experts.

According to the theme of the conference, which is "Communicating Science, Technology and Medicine", the aim of this communication is to show how Molecular Biology became a reality in Catalonia during the 1960s and 1970s, through the correspondence between two of their main characters: Joan Antoni Subirana and Jaume Palau. Their scientific training was based mainly in the apprenticeship of laboratory techniques and the use of laboratory instruments, and the study of their scientific publications became essential for this research together with their correspondence.

This correspondence, consisting in fifty-five letters written by Subirana from 18th December 1961 to 31st August 1968, has permitted a follow-up of their careers and the development of their research projects and has also given information about the Spanish scientific situation during the 1960s. The great amount of details concerning research, funding, techniques and so on, provide a frame in which we see that they were in the main stream of the research on chromosome structure, not only because of the amount of published papers, but also thanks to the collaboration established with the main research groups.

Session Title: Letters and Networks

ON THE CORRESPONDENCE FROM ASTRONOMERS TO HONORÉ FLAUGERGUES AND HIS UNCLE DE RATTE

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Abstract

Among manuscripts, preserved in the Archives of the *Observatoire de Paris*, there is quite a number of letters written, by several scientists, to Honoré Flaugergues (1755-1830), amateur astronomer, magistrate, and his uncle Estienne-Hyacinthe de Ratte (1722-1805), both located in the South of France. The references, in the inventory, attain 243. The greatest number corresponds to Lalande (1732-1807); the paper will give a short overview on their publication, in print in 2007, by Simone Dumont and Jean-Claude Pecker, and on the next one to come on Lalande's correspondence to Berliner astronomers. The main part of the paper will be an examination of the letters written to Flaugergues and de Ratte by well known scientists. Among them, authors of several letters, are Delambre (1749-1822), La Caille (1713-1762), Méchain (1744-1804), Messier (1730-1817); some others are only present with one or two letters such as Bouvard (1767-1843), Laplace (1749-1827) or Schumacher (1780-1850).

Session Title: Letters and Networks

'THE HONOUR OF CORRESPONDENCE WITH SOME ABROAD': EPISTOLARY NETWORKS OF THE DUBLIN PHILOSOPHICAL SOCIETY (1683—1709)

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Abstract

Writing to a country member of the newly formed Dublin Philosophical Society (DPS) on 22 March 1683/4, William Molyneux thanked him for his account of the county of Roscommon, and told him of the progress of the society, with particular reference to the links established with the 'curious and ingenious' outside Ireland. In an organisation which owed its origins to an attempt to gather a natural history of Ireland in Baconian terms, and with a strong emphasis on usefulness and 'improvement' in a colonial context, the links between the members of the DPS who were dispersed across Ireland, and the links of the Dublin society with its model, the Royal Society in London, and with its sister society in Oxford, figure largely in the proceedings of the society. The activities of relatively minor players in the development of the epistemological status of natural philosophy, such as the members of the DPS — those who resided physically or intellectually on the periphery — and the degree to which they understood, acquired, and participated in the adoption of new notions proposed by the major players, such as those associated with the Royal Society, and promoted in the wider intellectual world by such influential individuals as Pierre Bayle, are explored via the nature and form of their epistolary networks. The patterns of connectivity established between individuals and, more formally, between organised groups, are described by a return to the language of the correspondence and by visualisation and quantitation techniques derived from social network analysis. The significance of repetition of experiments and observations in the operation of intellectual feedback between individuals and organisations at the 'centre' and 'periphery' of early modern natural philosophy is a notable feature of these networks.

Session Title: Letters and Networks

RTFM! SCIENTIFIC MAILING LISTS AS A MEANS OF COMMUNICATION: A NOVEL KIND OF CORPUS

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Abstract

Unlike nowadays web 2.0, the nineties Internet was something different from the social network that is described (and mapped) today. Yet, the democratization of the personal computer and the availability of a worldwide academic network created new forms of communication between scholars.

To account for the strategies, tensions, and changes over time in a community of scientists, this work explores The Computational Chemistry List (CCL), a mailing list created in 1991 to provide a discussion board to a fledgling community. For twenty years, it has been used as an opinion forum and a platform for scientific exchange. Since its inception, through the archives of its thousands of threaded conversations, the CCL mailing list is a valuable corpus, with its trolls and flame wars particularly helpful in revealing the tensions and controversies within the community. The arena of the mailing list can be viewed as a backstage in a "representation of self" Goffmanian perspective: a place where people act differently than on the front stage, and a place where they actually build the play.

From the historian point of view, The "threaded conversation" format of mailing lists is a unique form of computer mediated communication that permits the analysis of debates. It also allows to do so in novel ways: From the diachronic analysis of metadata to the social network analysis of topics and contributors, the corpus is available for quantitative analyses in complement with the ethnographical qualitative analysis of discourses.

Session Title: Letters and Networks

GAUSS'S VIEW OF ABEL'S WORK: THE ANALYSIS OF CORRESPONDENCE

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Abstract

The paper focuses on Gauss's attitude to Abel's algebraic work in the context of communication among German-speaking mathematicians in 1820s.

In 1800s, classical algebra was almost totally closed discipline of mathematics. A problem still opened was that of proving solvability of quintic equations in terms of radicals. In general, solvability became a new epistemological phenomenon in the beginning of 19th century. On one hand, Gauss described the boundary of mathematical knowledge by the Fundamental theorem of algebra, i.e. putting the principal result on existence and the number of solutions of general polynomial equation. On the other hand, the problem of finding a formula that would be a solution of quintic equation still remained. It was not rigorously resolved until Abel's negative answer: there is no algebraic solution.

In 1820s, both Abel and Gauss, held different epistemological ideas on mathematics - "calculative" Abel related to "combinatorical analysis" (Cauchy, Jacobi or Sommer) vs. "geometrical" Gauss associated with numerical interpolations (Bessel, Lagrange or Newton). These epistemological aspects of mathematical knowledge are also mirrored in the correspondence between Gauss and his friends (H. C. Schumacher, F. W. Bessel, H. W. M. Olbers). Gauss's interpretations of Abel's work (and Abel's topics) represent a direct testimony of the period, communication, and mathematics in 1820s. The letters sketch out their producers (Gauss, Schumacher, Bessel ...), contrasting the production of knowledge of that time (Abel, Jacobi, Wroński, Sommer ...). Furthermore, events, described in Gauss's letters, sign other details on Abel's papers and life (e.g., possible Abel's visit of Schumacher in Copenhagen in 1823) in contrast to standard Abel's biographies (Ore 1974, Pesic 2003, Sørenson 2010).

Session Title: Taming the Natural World and Relocating Genetics

PREPARING FOR THE *PHILOSOPHICAL VOYAGES*: THE FIRST COLOURFUL ILLUSTRATED FLORA MADE IN PORTUGAL

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Abstract

1783 is the year of the departure of the four Portuguese *philosophical* voyages to overseas territories – Brazil, Angola, Mozambique-Goa and Cape Verde. The last quarter of the 18th century corresponds to the period of greatest progress of Natural History as a scientific discipline in Portugal. Much due to the strong institutional and financial boost provided by the Portuguese crown, as well the context created by the reformist policies of Marques de Pombal and the ministers of Queen D. Maria I, and the commitment of Domenico Vandelli as well many wealthy amateur and professional naturalists.

In the timeline of the Portuguese Natural History many others events have happened before this achieve. In 1780 and under the directions of Vandelli, director of the Real Jardim Botânico da Ajuda, two important events took place: 1) the founding of Casa do Risco (house of drawing of the Real Jardim Botânico da Ajuda), with a body of professional artists; and 2) the production of an unique botanical work richly gold bound and magnificent colourful illustrated entitled "Specimen Flora Americae Meridionalis". This botanical work consist of four volumes, the first three volumes have 288 great quality black and white and colourful illustrations, drawn by seven Portuguese artists, mainly American plants in their flowering and fruiting stages, and the fourth volume with descriptions of the species classified according to Linnaean taxonomical system. From all the 288 botanical illustrations, circa 240 colourful illustrations are copied versions of the drawings of the Spanish botanical expedition to the Viceroyalty of Peru (1777-1788).

Our research intends to reveal the story of the production of this magnificent scientific artwork, showing the quality of it and discuss the preparatory work that naturalists and artists were doing in Portugal to prepare for the unknown Nature present in overseas territories of the empire.

Session Title: Taming the Natural World and Relocating Genetics

PLANTS AND FISHES: THE INCURSIONS OF A PORTUGUESE AMATEUR COLLECTOR IN XIXTH CENTURY NATURAL SCIENCES

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Abstract

Augusto Goltz de Carvalho [1858-1913] was a school teacher in a small coastal village, in central Portugal, whose interests in life had a broad scope, from archaeology to linguistics, from the theatre to the natural sciences. From a young age, he established a long and fruitful relationship with botanists and zoologists at the University of Coimbra, with whom he corresponded for much of his life.

This small initial network of contacts at Coimbra soon expanded to encompass several more connections and by the late1880s, Goltz de Carvalho was collecting botanical and zoological specimens for several researchers and institutions, in Portugal and abroad (Belgium, Sweden, Austria, USA, etc.). In the process, he acquired a considerable knowledge of several scientific fields and was able to identify local flora and marine fauna (ichthyology and malacology).

The analysis of the correspondence he received allows us to rebuild the expansion of his scientific network, the processes and methodologies through which he participated in biological specimens collections and acquired the recognition as *bona fide* naturalist.

This paper highlights the importance of private correspondence archives in providing information on scientific practices and the constitution and development of biological collections (herbariums, natural history museums and botanical gardens) and the contribution of amateur naturalists in Portugal for the maintenance and expansion of botanical and zoological networks of biological specimens' exchange in the late 19th century.

Session Title: Taming the Natural World and Relocating Genetics

COMMUNICATING NATURAL KNOWLEDGE THROUGH HANS SLOANE'S 'VEGETABLE SUBSTANCES'

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Abstract

Sir Hans Sloane's (1660-1753) collection of 'Vegetable Substances' consists of over 8000 surviving objects, largely botanical in nature, which are currently housed in the Natural History Museum, London (NHM). This paper will discuss the role of this collection in formulating and exchanging knowledge about the natural world between the late-seventeenth and mid-eighteenth centuries. Sloane was a prominent figure in London as a Court physician and President of both the Royal Society (1727-1741) and the Royal College of Physicians (1719-1735). By the time of his death, he had amassed a set of vast collections including nearly 300 bound volumes of dried plants, approximately 50,000 books and manuscripts, natural objects including fossils, shells, corals and animal specimens, and over 32,000 coins and medals. These are now dispersed between the British Museum (BM), the British Library (BL) and the NHM. The 'Vegetable Substances' forms part of Sloane's botanical collection with a corresponding hand-written catalogue listing 12,523 items and information about each object, such as from whom and from where it was acquired, and its perceived utility (e.g. as food and medicine). By using the information from the catalogue and Sloane's extensive correspondence about 'what' is in this collection (predominantly botanical material such as seeds, roots, leaves and bark, as well as gums and balms, along with *curios* and ethnographic objects), the people and places from whence they came, and ideas about the materiality of this collection (how it was put together), my paper will explore the ways in which Sloane was communicating knowledge about the natural world through his constantly growing collection of 'Vegetable Substances'.

Session Title: Taming the Natural World and Relocating Genetics

FRANÇIS-FREDERIK STEENACKERS AND THE STUDY OF JAPANESE FISHES IN FRANCE IN THE 1880'S

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This paper sheds light on Françis-Frederik Steenackers (1858-1917) and his role in scientific and cultural transmissions from Japan to France. Steenackers arrived in Japan in 1881, served as French consul in Kobe (1885-88), vice consul in Nagasaki (1891) and consul in Yokohama (1900-06). Little is known about his life there. In 1885, he and Tokunosuke Ueda, who worked for the French Consulate in Yokohama, published "Cent Proverbes Japonais." It was translated from the book of 100 Japanese proverbs, illustrated by a famed Japanese artist, Kyosai Kawanabe (1831-1889). Kyosai sketched Steenackers in his picture diary on April 25, 1881, an indication of their personal relationship.

Beginning around 1890, Steenackers sent a huge collection of decorated incense boxes of *kogo* to Georges Clemenceau (1841-1929), later Prime Minister of France. About 3,000 of them are now in the Montreal Museum of Fine Arts.

Archival documents record Steenackers went to Japan in 1881, to "collect scientific objects." "In 1888, proposed by the Museum of Natural History, and especially, Armand de Quatrofages, a member of *l'Institut de France*, he was made a chevalier of the *Légion d'honneur* for his ichthyological and anthropological collections from Japan, which enabled French scholars to spread scientific knowledge of Japan (Ministère des Affaires Etrangères, Paris, Dossier agent F. Steenackers, No. 1451)." However, little was known about the nature or extent of these collections.

This paper, based on my research in the Muséum national d'Histoire, Paris, focuses on Steenackers' collection of fishes from Lake Biwa. These were studied by French biologist, Henri Émile Sauvage (1842-1917). In 1883, he reported 32 species of Japanese freshwater fishes mainly from Lake Biwa. Those included several new species found only there, including the cyprinid *Ischikauia steenackeri* (Sauvage, 1883). This was the first scientific report focused on the endemic fishes of Lake Biwa.

Session Title: Taming the Natural World and Relocating Genetics

THE PORTUGUESE CONTRIBUTION TO THE NEW WORLD PRIMATE NATURAL HISTORY IN THE EARLY MODERN AGE

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Abstract

The natural history of the New World primates began with the European expansion in the Americas. New, awkward first-hand information and also live specimens reached Europe since the first decade of the 16th century. All these information were progressively incorporated by the work of the European naturalists and natural philosophers undermining the traditional conceptions about primates based on the Middle Age bestiaries and contributed to a more empirical approach to this discipline. As testify by many literary and iconographic sources in all the phases of the Portuguese expansion in Brazil, primates were a constant presence. Firstly it is possible to find acute morphological and behavioural observations of howler monkeys (genus *Alouatta*), muriquis (genus *Brachyteles*) and callitrichids in the Portuguese travel literature and chronicles of Brazil. Secondly Portuguese start a big trade of monkeys. The smart and small Neotropical primates were new to European courts and quickly became appreciated as pets. They represented an authentic status symbol that underscored their owners' influence and social position. Monkeys (together with parrots) were among the most common animals brought back to Lisbon. Portuguese ship's logs that reached us show high numbers: one ship could transport until 300 monkeys (e.g. Nave Bretoa ship's log). Most of them from Lisbon were sent to Antwerp where the German Fugger family had a facility for keeping and selling exotic animals to the rich personalities of Northern Europe. Due to the presence of these primates at the noble residences and to their contact with the artistic and cultural medium, the interest and the knowledge about New World primates became quite consistent during the 16th century. Moreover some species were portrayed and described in the most important naturalistic works of that time such as *Historia animalium* of the Conrad Gesner and *De quadrupedibus digitatis viviparis* of the Ulisse Aldrovandi.

Session Title: Taming The Natural World And Relocating Genetics

A DIALOGUE BETWEEN GLOBAL NORMS AND LOCAL FORMS: THE CASE OF NATIONAL BIOBANKS

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Emerging along with the advancement of population genomics under the goal of achieving personalised medicine, creating biobanks for genomics research has become an international trend in recent years that makes this new form of biotechnologies turn into global assemblages in cosmopolitical technoscience. Global capitalism renders large-scale population biobanks both a research platform and a state enterprise, considering the underlying linkage between biobank initiatives and the rise of biocapital for a nation state. Biobanks - collections of human biological materials linked through genetic information - have attracted considerable attention across the globe. These global assemblages of capital and vital politics have led to innovative institutions and arrangements in fields of technoscience and ethics. Though biobanking is an apparently global phenomenon, diverse political innovations and ethical configurations emerge from the specific social and cultural milieux, in which its establishment and operation are situated. In many countries, like UK, Estonia, Iceland and Taiwan, national biobanking projects witness how biotech innovation is implicated in the formation of biocapital and the politics of life. The national biobanks can be viewed as useful indicators to interpret and reconstruct the notion of biotech modernity in the biomedical reality. It demonstrates the governments' endeavours to catch up with the international trend in genomics research and pharmaceutical development when biobanking articulated not only the scientific imagination but also nationalist aspirations to end the exclusion of the country from the biotech competition at the global stage. This paper explores the dialogue between global norms and local forms by viewing the process of "localisation" of global capitalism by national biobanks in order to realise how global norms may have been adopted and adapted according to different local needs and social settings.

Session Title: Taming the Natural World and Relocating Genetics

SOVIET SEEDS, AMERICAN SUGAR BEET: PLANT GENETICISTS THE SAVITSKYS AND THE TRANSMISSION OF BREEDING PRACTICES

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Abstract

The most dramatic waves of the Russian emigration occurred in the first decades of the Communist rule. In this paper I will present one peculiar émigré story that started in the Soviet Russia of 1930s-40s, continued in the post war Western Europe and ended in the USA. The focus of the paper is on the circumstances of life and work of a married couple of geneticists and plant breeders – Vyacheslav Fabianovich Savitsky (1902–1965) and Elena Ivanovna Kharechko-Savitsaya (in the USA – Helen Savitsky) (1901–1986). Their fate was utterly exclusive: the Savitskys had chosen to continue their research on hybrid sugar beet under Nazi during the occupation of the Soviet Union in 1940s, and then left their homeland with the retreating German troops. In this paper I will analyze the multiple reasons for their emigration.Thus, this is the story of the collaboration of the Soviet scholars with the German authorities and their subsequent emigration. Such a theme very rarely, if ever, becomes a subject of historical discussion.

The Savitskys story has yet another dimension connected with the transmission of knowledge and objects. Indeed, within its context, the term ‘emigration’ takes a new meaning, because not only *scientists* but also *scientific objects* migrated. Moreover, there were *objects* of research that influenced the fates of the *scientists*. Therefore, emigration could be explained not only by political, ideological and other external reasons, but also by the intention to go on with the experiments aimed at transmitting/spreading of unique scientific practices and materials to the world community of plant geneticists and breeders.

Session Title: Taming the Natural World and Relocating Genetics

THE REPORTS OF JOHN GOSSWEILER ABOUT ANGOLAN COFFEE PRODUCTION (1919-1939)

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Why did colonial Angola become a coffee economy after Word War II? The question has been addressed in the historiography from two angles. Economic historians have stressed the increased demand for Robusta coffee after WWII – the type of coffee planted in Angola. On the other hand, the historiography of colonial Angola has underlined the policies created by the colonial power to facilitate large capitalistic enterprises devoted to coffee production. But – are those reasons (economic and political) enough to explain why Angola became a coffee economy? Why was not cotton the plant to succeed, or sugar? This paper proposes to readdress this question from a different perspective. My claim is that environmental conditions of the mountain rainforest of North Angola – where coffee grew spontaneously – also took an important role. Such an environmental claim is based on the reports produced by the scientific expertise of the Agriculture Department of Angola during the interwar period – namely, by the Suisse botanist John Gossweiler, responsible for the agronomic missions to the coffee-producing regions. This paper wants to put this agro-ecological awareness in the context of the history of science (namely, plant geography and ecology) and imperial history. Moreover, it wants to discuss the richness and limitations of these reports – published in the journal of the colonial department – as sources to connect imperial repertoires of power and local environmental histories.

Session Title: Taming the Natural World and Relocating Genetics

THE DEVELOPMENT OF GENETICS IN THE SOVIET UNION FROM THE SECOND HALF OF THE 1960s THROUGH THE FIRST HALF OF THE 1980s

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Abstract

The topic of the paper is devoted to the social, economical and politico-ideological factors in the development of genetics in the USSR. Specifically, it emphasizes 3 main aspects: politico-ideological problems from the second half of the 1960s through the first half of the 1980s, international relationships of the Soviet geneticists, and the material and technical base of genetic research. In those years, the social and political environment became more favourable for the development of genetics in comparison to the previous period of Lysenkoism (1948–1964). Genetics became considered a legitimate field of research and even received some governmental support after Nikita Khrushchev's dismissal (1964)**.** Soviet scientists expanded their international contacts. The XIV International Genetics Congress (Moscow, 1978) was the most visible example of Soviet geneticists overcoming their isolation from their colleagues abroad. However international contacts were very difficult to establish and maintain because of the "Iron Curtain", problems with obtaining permission for travel abroad, increasing tensions between the Soviet Union and Western democracies, and the language barrier. The internal political and ideological context of genetics research improved. However, political and ideological factors had a destructive influence. The impact of Lysenkoism was still felt in many institutions and areas of research; direct criticism of Trofim Lysenko and his theories was not tolerated; in this environment no objective history of the discipline could be produced. Poor material support of research also exercised a negative impact. Economic conditions of a country that was plunging into "stagnation" imposed considerable constraints on research infrastructure and scientists' living conditions. Thus, these years can be seen as the period that witnessed considerable positive changes in genetic research in the USSR, yet the legacy of Lysenkoism was not overcome. Acknowledgments: The research project has been supported by the Russian Foundation for Humanities, grant no. 12-33-01295.

Session Title: Circulating Knowledge in the Ancient, Medieval and Early Modern Periods

INFORMATIONS AND LAWS ABOUT THE NATURAL WORLD FROM NEW SPAIN, XVI CENTURY: KNOWLEDGE AND COLONIZATION

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Abstract

This study aims to analyze the relationship between colonization and knowledge about the natural world in the sixteenth century of New Spain. During Felipe II´s government, there was a project that aimed to collect information about the natural world and arrange them so as to serve as a tool for Spanish colonization. Thus in the sixteenth century was vital to the success of the colonization, the search about the nature potentialities and the native knowledge. This study analyze this questions through two documents: Leyes e Ordenanzas – nuevamente hechas por S.M. para la gobernacion de las Indias, y buen tratamento y conservacion de los índios, prepared in 1544 , and Informe al Rey por El cabildo eclesiástico de Guadalajara acerca de las cosas de aquel reino, written between the years 1569 and 1570, probably by the Registrar Antonio Rodriguez. These documentary sources tell us about aspects of Spanish colonization in New Spain through the necessary creation of norms and laws for the political and to establish a successful colonization. The potential of the natural environment of the Valley of Mexico , the need to search for information for the survival and installation of Spanish colonial structure and the obtaining information on indigenous knowledge in relation to the local nature are issues in this documents and those aspects will be more closely analyzed in this research. Another aim of this study is to present the circulation of information in the sixteenth century Spanish empire.

Session Title: Circulating Knowledge in the Ancient, Medieval and Early Modern Periods

DIPLOMAT SCHOLARS: THE TRANSPORTATION OF LEARNING THROUGH POLITICAL NETWORKS IN RENAISSANCE CENTRAL EUROPE

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Abstract

Recent studies of court- and university-based scholars have improved our understanding of the multiple localities of natural philosophical work during the Renaissance and early modern periods. This paper will examine a number of early 16th-century individuals who crossed freely between these domains as a result of short-term diplomatic assignments that allied them with different circles at different stages of their lives. Political leaders found it desirable to call on scholars, some of whom also held university-based positions, when they needed individuals with the linguistic abilities and perceived eloquence to handle delicate negotiations and/or public ceremonies. For their part, scholars found that these occasional or regular assignments offered opportunities to solicit patronage for the production and dissemination of their work, as well as even occasionally providing raw material for writings on geography, ethnography, or other subjects (as with Sigismund von Herberstein's *Rerum moscoviticarum commentarii* (1549), based on observations from his negotiations in Russia on behalf of the Habsburgs). Overall, the travels, meetings, and courier networks associated with ad hoc diplomatic missions helped knit together a community of scholars that was scattered across diverse university, court, and church hierarchies in an era before these boundaries became less fluid. This paper will reconstruct the traces and influence of these networks as seen in examples such as the paths taken by manuscript writings of figures like Nicholas Copernicus, whose ideas were explained to the pope in 1533 by a linguistics scholar with a career in secretarial and diplomatic service to various figures, whose draft astronomical tables were transmitted to von Herberstein by a Cracow professor who also served as a church canon and secretary to the king of Poland, and whose superior as bishop of Warmia had previously served on diplomatic missions for both the Polish king and the Holy Roman Emperor.

Session Title: Circulating Knowledge in the Ancient, Medieval and Early Modern Periods

COMMUNICATION OF KNOWLEDGE AMONG ASSYRIAN AND BABYLONIAN SCHOLARS

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Abstract

While writing was used extensively for administration in ancient Mesopotamia, nothing that could be called publication of knowledge was available at the time. More often than not, knowledge was intended to be kept secret among the specialists, not to be spread to the outside. There were nevertheless ways to communicate knowledge among experts.

So-called procedure texts are addressed to a prospective reader, and some medical recipes are intended for other practitioners. We also have letters from experts in omens to the Assyrian king (who was not an expert himself), explaining details necessary to justify actions proposed. Some of these letters are written by two scholars together. There are occasional quotes from much earlier reports to which the later scholars must have had access in some way.

The paper describes how scholars could exchange ideas.

Session Title: Circulating Knowledge in the Ancient, Medieval and Early Modern Periods

BRINGING THE KNOWLEDGE HOME: SCIENTIFIC INNOVATIONS THROUGH TRAVELLING IN THE PRE-CLASSICAL PERIOD

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Abstract

Scientific progress was not always meant to be the results of certain lab experiments. During pre-newtonian era, scholars either evaluated former theoretical knowledge produced by their ancestors or they introduced new fresh ideas through traveling in other areas.

The territories of the Greek-speaking Byzantine Empire, located in-between the european and the asian continents, offered a unique chance for mutual communication and interaction, either through official missions and envoys or through travelling merchants at those areas. We will focus on this viewpoint presenting aspects of works of Symeon Seth (11th century) and Cosmas Indicopleustes (6th century AD) which indicate significantly civilizations' interaction. Also, we will trace the impact of travelling on the progress on Astronomy bringing forward some travels of important scholars.

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

THE CIRCULATION OF MATHEMATICAL KNOWLEDGE IN THE EIGHTEENTH CENTURY: ERASING BORDERS BETWEEN LEIBNIZ AND NEWTON

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Since the eighteenth century, an increasing number of historians of science have pointed to the major role played by textbooks in the circulation of the scientific knowledge in Europe. These textbooks played an important role in the formation of several scientific disciplines which were emerging at that time. The role of the undervalued popularisers in shaping a discipline was crucial.

It is still necessary to analyse several aspects of the communication process and the circulation of Differential Calculus as a new discipline in the eighteenth century, but at this moment a detailed analysis of this process, as many historians of science have emphasized, overturns the cliché regarding the history of the origin of Differential Calculus based in the Leibniz-Newton controversy. The borders between the two approaches often become blurred, and every actor involved in this process, like the follower of any vision, crosses these borders.

Tomàs Cerdà was a Jesuit, mathematician, and teacher who lived and worked in Barcelona and Madrid in the late eighteenth century. Our project is focused on Cerdà's contribution to the introduction of Differential and Integral Calculus in Spain as well as on Cerdà's appropriation of Thomas Simpson's work.

Our aim, firstly, is to analyse this appropriation as an example of how teachers helped to shape a new discipline, and secondly as an example of the permeability between the Newtonian and Leibnizian visions.

With a few examples taken from Cerdà's *Tratado de Fluxiones* and Simpson's *The Doctrine and Application of fluxions,* we will first analyse the similarities and differences between the two works; secondly, we will assess the contributions of these two teachers, not only to the popularization process of the scientific knowledge, but also to the production process of this scientific knowledge; and, finally, we will consider the "heterodoxy" of some of the approaches of these Newtonian authors.

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

INVENTORIES AND INSTRUCTIONS: INSTRUMENTS TO OBSERVE, KNOW AND MOVE NATURAL SPECIMENS IN LATE 18TH CENTURY

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Abstract

In 1771, the Spanish monarch, Carlos III authorized the establishment and consolidation of the Royal Cabinet of Natural History, whose doors were finally open in Madrid until 1776. The aim of the museum was to gather in its collections, every representative sample of the Hispanic natural world in order to show the economic potential of peninsular and colonial territories. In its origins, the Royal Cabinet had been formed with the personal collection of the Ecuadorian Pedro Franco Dávila; but, even though his collections were important in quantity and quality, they were not enough to represent how wide and abundant the Spanish Empire was. In order to obtain the specimens that would enrich and extend the monarchical collections, Dávila, assuming its authority as Director of the Cabinet, established different strategies for the acquisition of natural objects. One of them was to ask correspondents in Spain, America and Philippines for the remission of animals, minerals and plants. Searching for the implementation of his politics, Dávila drafted a number of prescriptive documents or instructions which aims to educate potential naturalists or collectors in the practices of specimens observation, conservation, documentation and sending, even though he wouldn't know if his indications were going to be properly followed or not. When the specimens began to move from different points of Hispanic territories to Madrid, the inventories that travel along with the objects revealed how the prescriptive knowledge about nature and collecting had been transformed and materialized. Apparently, inventories would prove the efficacy of instructions, but, in fact these documents showed that prescriptions were not as successful as thought. My aim with this participation is to show how different actors involved in natural collecting used these paper technologies to consolidate and/or discard the prescriptive knowledge after its confrontation with practical experience and field observation.

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

NATURAL HISTORY AS A MEDIUM OF INTERCULTURAL TRANSLATION: SCIENCE IN THE DANISH-HALLE MISSION, C. 1706-1813

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Abstract

In the early eighteenth century the protestant Danish-Halle Mission in Tranquebar, South India, emerged as a local centre for the production and distribution of scientific knowledge. The aim of this effort was both to facilitate evangelization and teaching locally and in Europe, and to gain financial and political support from global and local sponsors. However, as the eighteenth century wore on the way science was understood and practised in the mission changed significantly. The missionaries' interests in science adapted to the arrival of Linnaean taxonomy in India via Tranquebar and its new mode of field research. At the same time, ideas of Physico-theology and Orientalism changed the missionaries' way of communicating science with the local Tamil population. Recent research has suggested that in this period at the end of the eighteenth century nature came to play a particular role for the mission as a medium of intercultural translation and communication.

In this paper I will investigate how the use of science as a translating medium changed in the Danish-Halle Mission through the eighteenth century. I will suggest that nature, or science as knowledge of nature, came to play a role as a less sensitive "zone" or space of interaction between the Halle missionaries and the Tamil population. Through this zone, the missionaries could approach the neighbouring and much more contentious zone of religion where their ultimate goal of conversion was situated, without risking major confrontations with the Tamils over religious issues. I will show how the missionaries employed scientific texts, objects and instruments as a medium for translations in two directions: first of Indian categories, culture and objects from India to Europe, and later increasingly of Christianity, European ideas and objects from Europe to India.

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

KNOWLEDGE AS CONVERSATION. WOLFGANG KEMPELEN AND THE CULTURE OF GREGARIOUSNESS IN THE 18TH CENTURY SALONS.

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Abstract

In his work, "*Von der Kunst vernünftig und tugendhaft zu lieben*", which appeared in Halle in 1726, Christian Thomasius wrote:*"A man would be no reasonable man without the company of others. What use would thoughts be to him without other men? .....and where would he want to talk within himself, if other men with whom he lived with in society, did not, through their outside conversations, ignite his inner thoughts."* From this thought process he explained that man had a natural leaning towards a companionability which held pleasure, entertainment and joy. Community meant society. Cultivated and intelligent thinking –*"bel esprit",* unfolded. Knowledge became conversation and entertainment because reason ruled. Added to this come the psychological moments within a conversation, because they build the foundation of thinking, acquisition of knowledge, and truth. The pastime, the natural recovery is the delight of the spirit. In the 18th century the literary salon became the place for companionability and social interaction. In these mostly private circles topics were discussed, readings held, and music was played. There were also circles which orientated themselves towards political and scientific issues. In1783 Wolfgang von Kempelen set off from Vienna on his great two year travel through Europe with his "Chess Automaton" and his speaking machine, travelling through Germany and France to finally reach London. These two inventions were presented to small circles as well as larger civic paying audiences, as a sound scientific discovery. In these societies these two achievements were discussed, praised but also criticised by experts of the time. These small, fine circles of society served not only as a stage but also as a management, since the ideas were presented to a very influential audience who contributed to the financing and spreading of important events.

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

COMMUNICATING ASTRONOMY: THE ROLE OF THE PORTUGUESE DIPLOMATIC NETWORK DURING JOÃO V'S REIGN

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Abstract

The relations between science and diplomacy have been to a great extent neglected by historians of science for periods prior to the twentieth century. This communication is an attempt to explore this still uncharted subject. In this paper I will address the multiple ways in which the Portuguese diplomatic network participated in the communication of astronomy during João V of Portugal (r. 1707-1750) reign. Before the Treaty of Madrid (1750) – when Portugal and Spain reached a first agreement on the borders of their South American colonies – precise longitude and latitude determinations, made by Jesuit astronomers, were the main astronomical contributions to geographical explorations and cartography in Brazil. Human and material resources employed in these activities and in observations performed at Lisbon were acquired almost entirely in external kingdoms. The Portuguese diplomatic network was the organizational structure that allowed for the entry of astronomical books, astronomers and instruments. Portuguese ambassadors were also responsible for starting communication with the *Royal Society*, in London, and the *Académie Royale des Sciences*, in Paris; as well as for the first contacts with leading astronomers in France, England and the Italic Peninsula. In this respect the Jesuit Giovanni Battista Carbone (1694-1750), João V's royal mathematician and astronomer, acted as a central figure, not only occupying a prominent position within the Portuguese diplomatic network – and coordinating all astronomical communications – but also as a meeting point with the powerful Jesuit network. Serving the political aims of the state, of control over disputed territories in South America, Portuguese ambassadors helped to promote astronomical practice, increasing the geographic knowledge of Brazil and the image of a modern country active in astronomical investigations.

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

INDUSTRIAL 'PROPERTY', LAW AND INVENTORSHIP IN GREECE 1914-1974

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Abstract

The paper focuses on the co-construction of industrial 'property' law and the culture of invention in Greece the years from 1914 to 1974. It traces the legislatives changes for almost sixty years from the post WWI years to the restoration of democracy in 1974. While covering a rather long period the focus is well defined in three specific periods: the years surrounding the first patent law in the 1920s, the WWII and its impact in the legislative culture on 'IP', and the third is the European Patent Convention in 1973 and its appropriation and impact on the 'IP' and the culture of inventorship in Greece. The research questions that the paper aims to address and answer are: What was the social and political context of the introduction of the first patent law in Greece? What was the impact of the transnational legislative setting in constructing a culture of propertization of knowledge and more particularly in techno-science in Greece? What challenges and uncertainties created the new legislative context? How the propertization of techno-scientific culture co- constructed with legislative measures or the public discourses in relation to pressures for new IP laws and homogenization with central European developments. The paper argues that during the period of the study there was continuous pressures toward the delineation of Greece with European IP developments that under various conditions and different contexts were linked with the rhetoric of national 'progress' and 'growth'. A process of appropriation occurred in the making of IP laws and the shaping of inventorship in Greece, influenced by social, economic and ideological changes that occurred the years covered by the paper. The research is based mainly on published archival material most importantly on technical and legal journals, the Transactions of the Technical Chamber of Greece and those of the Chamber of Commerce and Industry, as well as on the public press, and legal books of the period.

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

SCIENTIFIC RESULTS AND CONSEQUENCES OF ÉTIENNE GEOFFROY SAINT-HILAIRE MISSION TO PORTUGAL (1808)

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Abstract

The French naturalist Étienne Geoffroy Saint-Hilaire was appointed by the direction of the Muséum national d'Histoire naturelle and by Napoleon to undergo on a mission to Portugal in order to visit the museological establishments of the country, to select and transport to Paris the specimens and collections he found important. In the occupied country, Saint-Hilaire visited the Royal Cabinet of Natural History of Ajuda, where he selected a considerable collection, as well as has made several field trips around Lisbon where he collected natural history products.

Both these collections integrated the Muséum collections, where they were studied by several European naturalists during the next forty decades, gave origin to the description of dozens of new species, and enriched the Parisian collections until today. Although, the mission had also considerable consequences in the Portuguese scientific community. Besides the initial confusion and immediate negative consequences, King Pedro V and the zoologist Barbosa du Bocage would use the event as an argument to benefit other Portuguese collections, while echoes of the episode still reaches present day.

In this paper, we aim to present an updated version of the event, based on new and unpublished data from Portuguese, Brazilian and French archives. Specifically we want to answer to several questions: What was the main motto of Saint-Hilaire?; How many specimens were transferred and how many remain today?; How many species were described based on these collections?; What were the consequences of this event to the development of the Portuguese natural history and its establishments?; Shall the specimens be reclaimed?; among other.

By integrating new data in the current historiographical knowledge of natural history in nineteenth century Portugal and Europe, as well as current taxonomic and biological debates, we present a novel interpretation and somehow radically different opinion about Saint-Hilaire mission.

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

THE ENZIKLOPÄDIE OF MATHEMATICAL SCIENCES OF FELIX KLEIN AND ITS CIRCULATION IN EUROPE

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Abstract

In the first decades of the Twentieth Century, the community of mathematicians of Göttingen, specially the German mathematician Felix Klein, idealized and edited the "Encyclopedia of mathematical sciences: with their applications", a huge editorial project. The six volumes of geometry comprehend four thousand and eight hundred pages, forty texts and thirty five authors. The numbers increase when we add the volumes of algebra and arithmetic, analysis, mechanics, physics, geophysics and astronomy. The project, which intended to be a complete portrait of the mathematical knowledge of the period, is very akin to the rising of the International community of mathematicians and other movements which seem delocalizing the mathematical knowledge. Some editorial strategies endorse this perspective: the editors of the geometry volumes chose the thirty five authors from six countries and the introduction emphasize the presence of many national traditions in their texts.

In spite of this, in this talk, we will show that the data on the circulation and reception of the Enziklopädie volumes are very controversial. Analyzing the citations of the Enziklopädie in the footnote format in some European periodicals, we observe a selective strategy in its reading by the authors of these periodicals. The texts on mechanics, physics, geophysics and astronomy are cited mainly in periodicals of physics whereas the mathematical part is considered only in periodicals of mathematics, contradicting the aspiration of Felix Klein who militated against the splitting of these subjects in the Enziklopädie.

Besides, the project seems to have a restricted diffusion outside Germany. Even the volumes of geometry which received many contributions of the community of Italian mathematicians had a mild reception in Italy. The collected data also asserts a short half-life of the volumes confirming the asseveration of some critics of the project.

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

THEMATIC CARTOGRAPHY IN VIENNA AROUND 1850: NETWORKS – INTERDISCIPLINARY COLLABORATION – COMMUNICATION OF KNOWLEDGE

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Abstract

In Vienna the institutionalization of thematic cartography began in the middle of the 19th century. At this time scientific and government institutions were founded (like the “Imperial and Royal Directorate for Administrative Statistics” in 1840, the “Imperial Academy of Science” in 1847, the “Imperial and Royal Geological Institute” in 1849, the “Imperial and Royal Geographical Society of Vienna” in 1856, etc.) and university chairs were established in the natural sciences and humanities. Most of these institutions dealt with thematic cartography. But was there an exchange of cartographic knowledge between these institutions? And if so, how was this knowledge communicated, and what innovations may have emerged from this? Did inter- and multidisciplinary cooperation develop in which cartographic knowledge was shared?

The lecture is based on the thesis that the extent of networking and the exchange of cartographic knowledge varied between disciplines and were often dependent on the interests of specific individuals. For example the geologists of the University of Vienna and the “Imperial and Royal Geological Institute” worked mainly on their own and establish an interdisciplinary collaboration in the field of thematic cartography only rarely. Contrary to this many geographers made contacts with scholars from other disciplines and were inspired by them. For example Friedrich Simony, since 1851 the first professor for geography at the University of Vienna, adapted a mathematical and geodesic “concept of space” that among other things enabled accurate measurements and calculations of natural conditions. An art oriented concept of space can be seen in his profiles and panoramas that he based on Austrian Biedermeier painting. Simony also influenced other scientists, like his colleagues Albrecht Penck, Eduard Richter and Johann Müllner (e. g. with different panoramas and depth maps of Austrian Alpine lakes), but also the poet Adalbert Stifter (e. g. "Rock Crystal” 1853, "Indian Summer" 1857).

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

MEDICINE LABORATORIES 1911 AND SCIENTIFIC TRAVELLERS

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Abstract

One of the most important features of History of Science is to keep in mind the phenomenon of cultural diversity since it encourages vigour and vitality, as it fosters respect for history and appreciation of the diverse varieties of human cultures and civilizations. History of Science can be the proper means of reflecting the advancement of human civilization and since the first International Congress on the HS in 1929 in Harvard, many changes in terms of structure; objectives, content and methodologies have been made.

The objective in studying science history does not lie in the simple reading of the evolution of the subject matter. Instead, the focal point is the interaction between the development of science, technology and society. In other words, Historians of Science of the 21st century will take it as their mission, to understand comprehensively the occurrence of science and its growth, and to promote the integration of scientific and humanistic culture. The generation of 1911, united by a common ideal of university and scientific research, formed a close-knit group with its own identity, in the contextualization of experimental medicine in Portugal. Their hypothesis was that clinical medicine should evolved to higher levels of study involving also experimental evidence, to achieve modernization in order to reach European model of medicine from Germany, France and United Kingdom.

This group of medical scientists, characterized by their idealism on cultural and scientific accuracy, was capable of implement this scientific methodology launching the medical studies through an European dimension, comparable to what was seen in Germany, France and UK in the same period. This is a good example where we can see the influence of networks of circulation and communication of knowledge.

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

PORTUGUESE ARCHAEOLOGY AND ITS NETWORKS DURING THE 60^{ies}: A FIRST GLANCE

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Abstract

In 1958, Lisbon hosted the 1st National Congress of Archaeology.

Postponed, in contrast to analogous meetings organized in other countries, it intersected generations of Portuguese archaeologists. Particularly, between those born in late 19th century, and young ones looking for new theoretical models. But, to accomplish this purpose, it was indispensable to minimize the internal traditional nearness to Spanish and French academicism, seeking for new archaeological and anthropological schools. This process became essential so as to find new paradigms, visions and synergies. That is why they were predominantly enthusiastic with the *Wheeler-Kenyon* stratigraphic method, while discovered and learned about the binfordian *New Archaeology* (1958).

Nevertheless, geographical closeness, individual interests and friendships, alongside with institutional - public and private -, agendas and shared topics, justified a long-standing collaboration among Portuguese and Spanish archaeologists. Fact made clear by several individual and institutional correspondences kept in diverse archives, such as the ones belonged to the National Museum of Archaeology (1893) and the Association of Portuguese Archaeologists (1863).

It is, therefore, our intention to rebuild networks of Portuguese making, circulation and reception of archaeological knowledge within Iberian context, and beyond it, identifying their head names, organizations, and research projects, except the ones concerning exclusively the overseas, for its own particularities. Finally, we will evaluate their influence on the establishment of Portuguese archeology, from the late '50s to the early '70s.

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

THE CREATIVE TWIST – TRANSLATING AND READING *GRAY'S ANATOMY* IN LATE QING CHINA

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This paper is a close study of how the dissection-based anatomy of British science, best embodied in the nineteenth century in Henry Gray's *Anatomy: Descriptive and Surgical,* was transmitted to late Qing (1850-1911) China through translation. It will also examine how the translation was received and misread by the local physicians who were traditionally trained to view the human body more metaphysically than physically within the cosmology of the *Wuxing* (Five-Phases) principles. It will focus on *Quanti chanwei* (1880) , the first Chinese translation of *Gray's Anatomy*, by Dauphin William Osgood (1845-1880), a fully trained MD and an American Board missionary, who arrived at Foochow, China in 1870. The paper will discuss the manner of Osgood's translation, his creative tackling of the cultural-linguistic problems involved (traditional Chinese culture held a strong taboo against human dissection), and how the translation was misread, due partly to Osgood's own imperfect command of the Chinese language, but more to the self-interested focus of the Chinese physician-readers, who tended to view western medicine as an offshoot of the Chinese prototype and hence usefully illustrative of Chinese medical principles. One such reader, Tang Zonghai' (1846-1897), is selected for the present discussion. His (mis-)reading, largely recorded in his best known theoretical treatise, *Yijing jingyi* (1892), was historically impactful, and has since exerted tremendous influence on the development of Chinese medicine.

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

CHEMISTRY, POLITICS AND SCIENTIFIC TRAVELS: JOSÉ CASARES GIL (1866-1961) AND THE COMMUNICATION OF KNOWLEDGE

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Abstract

Recent studies have shown how scientific knowledge is appropriated in local contexts by different historical actors with particular political and scientific agendas. Within this framework, scientific travels are regarded as important tools not only for the circulation of knowledge but also for the appropriation of different values, institutional models, material culture and tacit knowledge. This paper will be focused on the travels of José Casares-Gil (1866-1961), one of the main Spanish analytical chemists and professor of chemistry in Barcelona and Madrid who served as a "go-between" through Spain, Germany and the Americas.

First, it will be discussed the importance of his travels of learning, not only regarding the creation of international contacts but also taking into account the renewal of teaching and experimental practices in the Spanish universities. The books published by Casares, when he returned from Germany, are an example of an active appropriation of ideas and practices to the local context.

Second, it will be considered the role of Casares in the adaptation of institutional models to promote scientific exchanges in the first third of the 20th century. He was one of the founding members of the *Junta para Ampliación de Estudios*, JAE, (Board for Advanced Studies), whose main objective was the institutionalization of scientific travels, and the creation of networks of circulation and communication of knowledge between Spain and other countries.

Finally, the biography of Casares reveals the diversity of objectives pursued by a scientist in his travels. It will be studied how chemists like Casares not only acted as mediators in academic exchanges, but they were also involved in diplomatic activities, such as supporting to German chemists after the 1st WW, or articulating cultural and political relations between Spain and Latin America.

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

AFRICAN FLORA IN INTERNATIONAL SCIENTIFIC NETWORKS OF BOTANICAL EXCHANGE IN LATE XIX CENTURY PORTUGAL

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Abstract

In 1765, when Vandelli, an Italian naturalist wrote Linnaeus for his opinion on coming to work in Portugal, Linnaeus wrote back wishing him the best but complaining about the lack of botanical knowledge in Portugal and especially the disregard for “the rich nature” in Portuguese overseas domains.

Around the same time, Joseph Banks arrived in Lisbon and had much the same opinion, though he managed to obtain specimens from Brazil, and stayed in contact with the few involved in natural sciences investigations.

The vast reach of the Portuguese colonial territories was always a matter of curiosity in the European botanical circles, not the least fuelled by the scarce information on these regions and the fortuitous Portuguese endeavours to bridge this knowledge gap.

In 1865, Júlio Henriques presented is dissertation to the University of Coimbra on Darwin’s theory of evolution, a premiere in Portuguese academia. It would be through this botanist and professor at Coimbra for over 50 years, that the flora from the, then, portuguese tropical Africa would steadily make its way into European herbaria and botanical gardens. As Henriques established himself as the main Portuguese botanist, he received virtually every plant collection arriving from Portuguese excursions in Africa - fuelled by the European rush to the continent, and as a consequence of the Berlin Conference.

In this paper, we will present the inclusion of Portugal, an European peripheral country in terms of scientific development, and its overseas colonies flora, into the European scientific networks of botanical knowledge, in the late XIX century.

Comprising more than 1100 correspondents, Júlio Henriques extant received correspondence amounts to circa 5000 letters and allows us to assess the development, diversity, and growth of the network of botanical exchange, to track the type of actors, interactions and exchanged biological material, and the processes and practices of botanical knowledge production.

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

MEMORIES, *WORKS* AND *NEWSLETTERS*: ARCHAEOLOGY AND PREHISTORIC KNOWLEDGE IN MOZAMBIQUE DURING PORTUGUESE COLONIALISM

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Abstract

The establishment of the Board of Geographical Missions and Colonial/Overseas Research (Junta das Missões Geográficas e de Investigações Coloniais/do Ultramar) (1936-51/1952-1973) under the auspices of the Portuguese Ministry for the Colonies/Overseas introduced a new chapter in the production of scientific knowledge in and about the territories under Portuguese rule.

The Anthropological Mission to Mozambique (1936-1956), the very first organized under the aegis of this institution, played a significant role in the archaeological knowledge about this territory as its leader, Joaquim Rodrigues dos Santos Júnior (1901-1990), skillfully sought to detach the surfacing discipline from its collateral part.

Alongside this assignment conducted from the metropole, and following other colonial enterprises carried out in this field of study, mainly those in adjacent countries, local entities emerged that brought to light the prehistory of Mozambique.

Such were the cases of the Society for the Studies of Mozambique (Sociedade de Estudos de Moçambique) (1930), the Commission of Monuments and Historical Relics of Mozambique (Comissão de Monumentos e Relíquias Históricas de Moçambique) (1943) and the Scientific Research Institute of Mozambique (Instituto de Investigação Científica de Moçambique) (1955).

Besides supporting much of the research work, these institutions also become one of theimportant means by which science produced in and about Mozambique could circulate and gain new audiences. Provided with periodic publications of their own, they have published studies and reports and they have made known the interregional networks involved in the production of archaeological knowledge.

By considering the role of local periodic publications in the production and circulation of knowledge, this communication aims to look at both of its forms and contents in order to improve the knowledge about the role of archaeology in the Portuguese colonial agenda.

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

BANKS'S NETWORKS IN AFRICA: FROM INDIVIDUAL MISSIONS TO A COLLECTIVE PROGRAM OF EXPLORATION

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Abstract

This paper fits into a broader research project funded by the Belgian *F.R.S.-Fonds national de la Recherche scientifique*. It is entitled: *Africa in the "science policies" of France and Great Britain from the eighteenth to the mid-nineteenth century: the scholarly background of the Scramble*. This project aims at completing in an original way studies on the interactions between the "New Science" derived from the Scientific Revolution and the building of colonial empires in the Atlantic area from the Enlightenment to the apogee of the first Industrial Revolution. Its objective is to investigate how in this period Africa has become a scientific object in its own right for the colonial administrations of France and Great Britain.

In this paper I focus on the British side of the spectrum. I will investigate the changing British attitude towards Africa at the end of the eighteenth nineteenth century by focusing on the "Banksian" networks in Africa. It offers a series of useful examples that help to illustrate the transformation of British science policies under the pressure of competition with the French. Thus, it is my aim to show how Great Britain in the face of state-oriented French science has started to encourage its administration and scientific institutions to intervene more directly in exploration. Crucial in this evolution was the way in which the Admiralty absorbed the scholarly input of a number of learned societies and institutions, such as the Royal Society, the British Museum or the so-called "African Association" – the latter combining both scientific and commercial objectives. From the Individual research missions inspired by the omnipotent science organizer Sir Joseph Banks (1743-1820) exploration evolved into an imperial scheme relying on the collaboration between learned networks and the military, with the Admiralty strengthening its grip on exploration.

6th International Conference of the European Society for the History of Science, Lisbon, Portugal

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

COMMUNICATING EUCLIDEAN GEOMETRY IN COLONIAL INDIA: THOMASON'S ARABIC AND PERSIAN EDITIONS OF EUCLID'S *ELEMENTS*

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The parallel Arabic and Persian editions of Euclid (Calcutta School-Book Society, 1824) present an unusual solution for introducing Euclidean geometry to students in colonial India. The textbooks were published during the height of the Anglicist / Orientalist controversy and their publication history epitomizes the Anglicist / Orientalist controversy – although reprinted in the 1840s, by the 1850s they had been largely replaced by imported English textbooks such as Playfair's *Geometry*.

By the 1820s, education was considered an essential element to consolidating British political control in India. The Orientalists believed education must respect local Indian intellectual, linguistic, and cultural traditions – European learning should adapt to the local context. The Anglicists argued that Indians should assimilate to British social and cultural values, including use of English in academic instruction.

Thomas Thomason, editor of these editions, often favored the Orientalist view. His education plan for Bengal (1814) proposed a two-tiered system: high schools to teach English and modern sciences and village primary schools using local vernacular. Thomason's cover letter accompanying the manuscript of his editions emphasized the importance of geometry and mathematics for leading students beyond sterile logic toward modern sciences. But rather than translate a European textbook, he chose to edit classic Arabic and Persian mathematical textbooks. His goal as editor was to remove all later "accretions" from the text in order to present a "pure" Euclid suitable for teaching Indian students. Yet Thomason also seems ambivalent, for in 1826 he expressed doubts concerning the effectiveness of oriental languages for communicating Western science.

Session Title: Circulation of Knowledge — Contemporary Roots and Circuits

"A PERSONAL EXAMPLE HAS A MAGIC EFFECT ON THE SUBORDINATES": THE FEATURES OF ORGANIZATION OF N. PRZHEVALSKY'S EXPEDITIONS

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Nikolai M. Przhevalsky (1849-1888) is one of the most prominent Russian explorers of Central Asia. The success and extraordinary quantitative results of his expeditions were to the great extent promoted by his outstanding personality: his talent as a researcher-geographer, ample knowledge in different branches of regional studies, unique energy, as well as his extraordinary organizers' skills and distinguished personal qualities of the leader.

Przhevalsky called his expeditions 'scholarly reconnaissance operations'. He defined their objectives as observation, description, and collecting. For his followers he produced the handbook "How to travel in Central Asia" (St. Petersburg, 1888) where he identified the regions for further exploration and gave detailed recommendations for organizing and equipping research parties. Above all, this book reflects his attitude to Central Asia from the Imperial point of view.

The handbook "How to travel in Central Asia" consists of short chapters entitled in a way that reminds us of a program for teaching sociology of science: personality of a traveler, knowledge a traveler must have, success factors, system of scientific works, research tasks and many more specific questions of expedition structure. Przhevalsky pays special attention to personal characters of a leader of the expedition to Central Asia and expeditionists. He believes that their cooperation brings about the success of the business.

My paper analyzes this book by Przhevalsky and its implications for the later exploration of Central Asia by Russian travelers.

Session Title: Science Education in Place

A NOVEL CONTEXTUALIZED IN THE BARCELONA OF XVIII AS RESOURCE TO TEACH SCIENCE AND HISTORY

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Abstract

Based on the research of students' conceptions in science, we know that part of this knowledge is in conflict with scientific knowledge, and some students are reluctant to reconsider what they think. The knowledge of relevant episodes in the development of science can help teachers to better understand the students' thinking and some specific difficulties that students have related to some science' topics. Teachers have to persuade pupils of the value of the scientific way of seeing the world, which is a new way for the pupils. A novel could be an interesting resource to teach about Science, as well as about History and Culture of a key episode in the development of science in a specific country, institution, or of particular scientists.

We use a novel from Santiago Riera Tuèbols (2001), contextualized in the Barcelona of the end of XVIII Century. In that times, there was created in Barcelona a new institution, called at first Conferencia Físico-Matemática, and the argument of the novel is related to some academics of this Conference, Francesc Salvà Campillo and Antoni Martí Franquès.

Two chapters of the novel are analysed from a communicative-rhetorical approach and several elements are identified and analysed from the point of view of their capacity of convincing the students about science and the construction of scientific models, social history and history of science, and nature of science, especially about aspects of the methodology of the experimental work in Science.

The analysis of the texts will orientate how to use them in the classes, which questions could be asked to the students about or related to the argument of the chapters, if they could be of interest to the students, if the text can stablish a good communication with the reader, if it has capacity to convince them, as well as about other fundamental aspects useful for science education.

Session Title: Science Education in Place

ON THE GAME: REPRESENTING HIV/AIDS TO BRITISH CHILDREN THROUGH EDUCATIONAL GAMES, 1987-1992

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The representation of HIV/AIDS to children and young adults presented a unique problem for British health educators and policy makers in the late eighties and early nineties. Institutions previously tasked with quietly educating adults about sexual health, or children about 'the facts of life', were thrust into the awkward and publicly prominent new role of sex educators to the nation by the AIDS crisis. Institutions such as the Health Education Authority, British Medical Association and Family Planning Association were well placed to produce up-to-date and authoritative adult education materials on HIV/AIDS as the public health message evolved from one of nebulous risk to more explicit messages on safer-sex. However, the complex and difficult task of representing the sexual aspects of the illness and its prevention to children proved significantly more challenging.

Potential educators' attempts to produce coherent and comprehensive HIV/AIDS education material for children were stymied by anxiety over presenting children with explicit content; prohibitions against the inclusion of any content on homosexuality; battles for jurisdiction over the moral and sexual health education of children; and a pervasive sense of urgency. Nonetheless a wide variety of educational material was produced in these inauspicious circumstances including several 'AIDS Games'. Through exploring some of the variety of educational AIDS games produced by sexual health educators for children, this paper demonstrates how the complex difficulties around communicating AIDS to the younger members of Britain's population were manifested and overcome by educators and producers alike.

Session Title: Science Education in Place

CHILDREN OR PUPILS? STRATEGIES APPEALING TO SCIENCE TEXTBOOKS' YOUNG READERS

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Abstract

In drawing boundaries between popular science books and textbooks, many scholars have emphasized the compulsory nature of textbooks use: with the development of compulsory science teaching at school, textbooks reading audience appears arguably as a captive and involuntary one. While such elements affect textbooks production in a way that would imply that producers of school textbooks do not have to appeal to their students readers directly, the aim of this paper is to emphasize the effect of readership's representation on textbooks' content.

Based on a comparative analysis of science textbooks used in France, Poland and England during the second half of the Twentieth Century, it will focus on the editorial strategies used to raise children's interest in the book's contents and in science, and explore their effects on the shaping of a public image of science.

The paper highlights similarities that can be found in textbooks published in such different contexts as 1950s and 2000s France, England and Poland and shows how these similarities can be understood with regard to the construction of "scientific mythologies". It also explores differences revealed by the comparison, and proposes to understand these differences in connection with broader evolutions within pedagogy and science.

Session Title: Science Education in Place

A COMBINATION OF TEACHING AND RESEARCHING: THE PUBLICATIONS OF LAGRANGE'S LESSONS AT THE ECOLE POLYTECHNIQUE

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Abstract

On the subject of mathematical analysis, Lagrange had contributed three important works in his whole life. Since he published the first essay *Nouvelle Espèce de Calcul* in 1772, it took more than twenty years for him to return to the same topic. The establishment of Ecole Polytechnique gave him opportunities to develop and refine his ideas of giving the infinitesimal calculus a proper basis[1]. In the five years from 1795 to 1799 as he taught analysis at this school, he published two books as fruits of teaching. The *Theorie des Fonctions Analytiques*, appeared in 1797, was written progressively as the course went by[2]; and the *Leçons du Calcul des Fonctions*, published firstly in 1801, was a collection of the lessons he gave in the academic year of 1799. The two works also got republished with revisions or augmentations during the first decade of the nineteenth century in the *Séance des Ecoles Normales* or in the *Journal de l'Ecole Polytechnique*, whose objective was to support the instruction of the students and to spread useful knowledge of art or science. Based on these facts, some important questions are raised in my research: what are the differences between *Théorie* and *Leçons*, or the difference among the different editions of each? How and to what degree are these two works and their different editions related to Lagrange's teaching at the Ecole polytechnique? Based on an analysis on the contents and the structure of these works of Lagrange, in this paper, I will try to answer the questions raised above, so to reveal the teaching modes in this context.

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Session Title: Perspectives on Science, Technology and Education

KNOWLEDGE, POWER AND GOAN SOCIETY: THE MILITARY SCHOOLS IN PORTUGUESE INDIA

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From the middle 18th century, several military classes were taught in Goa following the creation of the military schools in Portugal, and the classes in Brazil and Angola. These classes gave way to the establishment of Military Academy created in 1817, which was the first engineering school in India.

The school underwent several reforms; some were the result of the difficult relations between Lisbon and the Portuguese Indian Army. In 1841, the Academy was closed and gave place to the Mathematic and Military School, also closed 30 years later.

Borrowing its title from Kapil Raj chapter "*Knowledge, Power and Modern Science: The Brahmins strike back*", this paper looks into the life of engineering training in Goa (1817-1871) examining the transformations in the military schools (teaching staff, the courses programs, some known scholar books, etc.) and its close relation with luso-descendants protagonism inside the schools.

It aims to understand how the military schools reflected the organization and the transformations (or perpetuations) in Goan society, echoing different agendas, and altering the way technology was taught and practiced in Portuguese India.

Session Title: Perspectives on Science, Technology and Education

ATMOSPHERIC SCIENCE IN PHYSICS EDUCATION: THE TEXT-BOOKS USED IN 19TH-CENTURY AUSTRIAN LOMBARDY

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Abstract

French models and local scientific institutions shaped physics education and practice in late 18th century Lombardy. Physics text-books usually handled with mechanics only. At the same time, astronomical observational research required the registration of atmospheric conditions. Post-Napoleonic Lombardy, part of the Austrian-governed Lombardo-Venetian Kingdom, benefitted from the coexistence of different scientific traditions due to the new influence from German models in physics education. Atmospheric science is a noteworthy chapter in the historical evolution of physics education in Austrian Lombardy. The dedication of one book by Aristotle to meteorology granted a high status to atmospheric science in German universities. The development of scientific instruments for the measurement of atmospheric quantities, not only in meteorological observatories but also on balloons, further strengthened the interest in the study and education in atmospheric physics.

The aim of this work is to analyse the chapters on atmospheric science in the main physics text-books used in Austrian-Lombard schools in a historical context. If Mozzoni's "Elementi di Fisica Generale" (1st ed. 1811, 2nd ed. 1827) continues the tradition of having only some notes on barometric measurements, later German-influenced text-books have one long chapter on the study of atmospheric phenomena, usually in the last section of the text-book together with the study of geophysical and astronomical phenomena. The Vienna Government suggested the use of the Italian translation of Baumgartner's "La Fisica congiunta alle Matematiche" devoting to atmospheric science more than one hundred pages on a total of about one thousand. A similar tribute is similarly found in Majocchi's "Elementi di Fisica" (1850) for high-school students, but also in Majocchi's "Elementi di Fisica" (1826) for elementary-school students.

Session Title: Perspectives on Science, Technology and Education

SCIENTIFIC ILLUSTRATION OF KNOWLEDGE IN EDUCATION

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Abstract

Here one of fundamental problems – the language capable adequately to describe a cognizable reality is put. Here the science in theoretical constructions is broken off in extreme measures between accuracy of the description (excluding metaphors, images) and completeness (due to metaphorically-shaped language). So, theoretical descriptions are strict, but fragmentary, and verbal are full, but not strict.

Complication of used techniques, becoming of specialized languages of a science has led to the following: 1) the experts working even within the limits of same disciplines, differently perceive an investigated reality, and, hence, they have various images of knowledge; 2) the scale of the world described by means of certain discipline decreases; in language of scientific community the concept «mosaic object» is even more often used; 3) break between is professional-theoretical style of thinking and "common sense" in which basis daily life experience lays grows; 4) there are "phantom" concepts, such images of knowledge which, owing to the sensational nature, are widely duplicated by mass-media though are not checked on conformity of scientific reliability.

There were serious changes in a plane of visual perception. That today there are the projects using digital technology of the image at creation of very capacious images which you will not name primitive is encouraging.

In the European culture formation is a training model of a science. In formation of new intelligence, in our opinion, rather perspective it can appear (and already there is) use

of the world of media – computer simulation – not only by way of transfer of the information, but, by way of generations new cultural an expert. The virtual worlds of computer simulation allow to simulate today in the cognitive purposes various (sensually not perceived) levels of a reality; to reproduce stereotypes of thinking, conceptual schemes, senses, symbols, methodology. Itself trained becomes be able to distinguish and choose various ways of thinking, and the teacher acts both as an expert, and as an intermediary between the various cultural worlds.

Session Title: Perspectives on Science, Technology and Education

IBERIAN ENGINEERS IN THE FRENCH *ECOLE CENTRALE,* AND «CENTRALIENS» ENGINEERS IN THE IBERIAN PENINSULA

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Abstract

The *École Centrale des Arts et Manufactures*, was founded in Paris in 1829, with the objective of training engineers to develop the country's industry and, to the most European countries it has become a reference in training this group of technicians.
In the 19th century and the first decades of the 20th century its influence was particularly important to the countries that followed a French model of technical education and had already a tradition of sending students to complete their training in France, as it was the case of Spain and Portugal.
When the Iberian engineers, trained in this school, returned to their own country they put into practice the knowledge they had acquired in public works and in different industries. Some of them followed a political career or had important positions in public administration.
We must also consider the interest of engineers from other countries trained in the *Centrale* in working in the Iberian Peninsula. The great enterprises that were looking for new investment opportunities were in a process of internationalization, namely those of gas, electricity or railways. Therefore several "centraliens" engineers went to the Iberian Peninsula to invest capital or to work.
Their stay in Spain or Portugal, where they were confronted with a another geomorphological environment and a different economy, put new technical and administrative challenges that forced them to develop their technical skills, which became an asset when they return to their countries or went to another country.
In this paper we aim to analyse:
1 - The Spanish and Portuguese engineers that during the19h and early 20th centuries have studied at the *Ecole Centrale* of Paris, as well as the activity that subsequently they have developed in their countries.
2 - The example of some engineers "centraliens" coming from France and other countries that have developed a professional activity in the Iberian Peninsula.

Session Title: Perspectives on Science, Technology and Education

TEACHING MEDICAL ETHICS: FAMILY INSTRUCTIONS FROM CHINESE PHYSICIANS

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Abstract

This paper employs *Collectanea* 袁氏叢書 compiled by Yuan Huang 袁黃 and published *Domestic Instructions* 家庭講話 published during the Daoguang reign to discuss how physicians transmitted professional instructions within the family generation after generation. This project intends to analyze what are the differences between the physicians' family instructions and family instructions in generation, which were often written by literati. Many family instructions are often written from a scholar's point of view. What are the differences between physicians' and scholars' professional expectations for their children? How did doctors in late imperial China see their own profession and technical trainings? How did physicians instruct their children to practice medicine, including knowledge, technology, and copying with doctor-patient relations? Final but not least, I will analyze how the concept of merits which had been integrated into Confucianism, Buddhism and Taoism synthesis impact on the writings of physicians' family instructions. Not only will this project provide new perspectives for the research of family instructions, but it will also shed new lights on the moral foundations of the society in late imperial China.

Session Title: Ways of Teaching

HISTORICAL DIAGRAMS IN EARLY LEARNING OF ALGEBRA

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Algebra is the language of mathematics but the introduction and use of this language is difficult because of the degree of abstraction that involves. In this paper we present a work proposal, implemented in the classroom with students in the 3rd year of ESO (15 years). In it, with the introduction of geometric historical diagrams related to the curriculum of secondary education, we promote the learning of algebra and the problem solving.

To the extent that the ontogenetic argument is useful in mathematics education, this reflection should cause us to rethink some current trends. Historically, the motivation for algebra came from the need to solve particular problems, both real-world problems, and those arising from mathematical investigations. Educationally it therefore makes sense to consider whether a problem-solving basis would be useful in the early stages of algebraic education. The focus it provides may help to overcome the barrier algebra seems to present for many people.

In the project presented here we begin from two ancient texts, the *Nine Chapters of mathematical procedures* (s. I), an anonymous classic book of ancient Chinese mathematics and *Hisab al-Jabr-w'al muqabala*, the treaty of the algebra by Khwarizimi (s. IX). In these works, in the absence of symbolic language of algebra developed centuries later, calculation algorithms are described in written form (rhetorical algebra). When the authors, or commentators later (in the case of the Chinese work was Liu Hui s. III), justify the calculations appeal to geometric figures and visual reasoning. These figures, which help the reasoning, are known as diagrams in the educational literature.

We chose to work with historical diagrams because using history in mathematics education aims to teach students that mathematicians do mathematics in a certain historical moment to solve specific situations.

Session Title: Ways of Teaching

FRENCH-GERMAN TRACES IN THE RUSSIAN EVOLUTIONISM OF THE 19TH CENTURY

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Abstract

When considering the reception of Charles Darwin in Russia, its peculiarities are still explained through the prism of the history of ideas, or – alternatively – the explanation focuses on the social, political, and ideological environment. The transfer of knowledge in the field of evolutionary biology through works written in French and German remain virtually unexplored.

As the literature shows, the traditions of the Russian academic community played an important role in the reception of evolutionary concepts in Russia. These traditions were formed by German scholars who worked in St. Petersburg and by their Russian students in the period when the debates on the limits of species' variability had just begun. The leading role in the dissemination of Transformism in Russia was played by biologists who were educated in German universities and who often began their academic careers in Germany; in general their research conformed to standards that were common to all European countries. Therefore the transformist views of Georges-Louis de Buffon, Lamarck's evolutionism, and Etienne Geoffroy Saint-Hilaire's saltationism had very few advocates among Russian biologists before the victory of Darwinism.

Later the transfer of evolutionary concepts to pre-Revolutionary Russia likewise occurred mainly through Germany. As a result, virtually all the approaches to the problem of evolution that existed at that time in Germany (Creationism, Transformism, Theologenesis, Teleogenesis, Haeckelian Darwinism, neo-Darwinism, Mechano-Lamarckism, Ortogenesis, Saltationism) had their own supporters in Russia. In Russia these approaches acquired specific features under the influence of national academic traditions and socio-cultural context.

Session Title: Ways of Teaching

DEVELOPMENT OF LOW COST STRATEGIES FOR PHYSICS COMUNICATION TO UNDERGRADUATE STUDENTS

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Science education is a social practice that has been increasingly expanded and developed in non-formal education spaces. There is agreement regarding the importance and need to develop policies and teaching strategies that effectively assist in the understanding of scientific knowledge through experiences that go beyond the teaching activity. The implementation of useful strategies for communication of science to students has been a growing challenge.

The STSE viewpoint (science, technology, society and environment) has been proved valuable in the stimulation of students' motivation. However, despite the recognized importance of historical contexts when dealing with scientific concepts, the textbooks do not adequately emphasize the history of science so that students acquire a more solid scientific literacy.

In this sense, the project *"Física Itinerante – Divulgação Low Cost"* aims to develop a diverse set of strategies for communicating physics, supported by an historical backbone that serves the purpose of motivating students to become more interested in Physics.

This project aims to bring the experimental and applied side of physics to some elementary and secondary schools in the Porto region. The objective is to promote interactivity between science investigation and school, motivating students' curiosity for diverse physical phenomena and the science that studies them. The aim is also to increase the Physics references in the lives of students, in order to attract and increase interest in learning this discipline on schools.

It is hoped that this project will provide greater disclosure of students' interest in Physics by developing ideas and the application of their knowledge in different contexts, with potential repercussions on better learning of Physical and other Natural Sciences.

Session Title: Ways of Teaching

THE SOCIETY FOR THE DISSEMINATION OF NATURAL SCIENCE EDUCATION AND THE WAY OF NATURAL SCIENCE TO SOVIET SECONDARY SCHOOLS (1918 – 1929)

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Abstract

The Society for the Dissemination of Natural Science Education (SDNSE) appeared in Saint-Petersburg at the beginning of XX century when Russian natural science tended to go beyond the universities and scientific communities. At the same time the natural science took specialized shape as a school subject in curricula thus there were teachers who tried not only to read the textbook but to form scientific outlook and to tell about the newest scientific achievements. In the late 19th – early 20th cc. the new generation of teachers came to Russian schools. They had a university background and were committed to the idea of bringing science to a wider public audience. After the October Revolution of 1917 the Bolshevik state supported the enlightened ideas of those educators. SDNSE and its activities as an excellent vantage point to explore the teaching natural science in Soviet secondary schools and its transformation in the 1918-1929. It was the time when new forms of science popularization and relationship between the state and scientists emerged. Among the members of this society there were prominent biologists. The first after-revolutionary programs for schools were written by SDNSE members. Thank to the activity of Society two congresses of teachers of natural science in 1921 and 1923 were organized. Research and excursion methods of teaching science were actively developed thus the society was closely connected with the system of school excursion biological stations. However as the time passed the state policy on science and education became more and more utilitarian, while the utopian ideas of that generation that stressed the civic activity of scientists were increasingly out of touch with the dominant state-sponsored ideology. Many of the members were in opposition to state educational policy not supporting the implementation of ¨complex programs¨ in secondary school and in 1930 a lot of them were imprisoned. That was the reason for the Society ceased to exist .

Session Title: Ways of Teaching

HISTORY OF SCIENCE IN THE CLASSROOM: METHODOLOGIES FOR THE UNDERSTANDING OF THE NATURE OF SCIENCE

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Abstract

The history and philosophy of science (HPS) has been addressed as one of the fundamental issues for reflexive, up-to-date and high quality teaching (Matthews, 1994). Among the various methodologies in use we can cite Galili (2011) that works with the development of teaching modules. In this paper, we show the positive and negative aspects of two methodologies for the integration of HPS. This project was developed with high school students for the study of gravitation and of energy. The first proposal was the presentation of these themes in groups, and the second, through the study of paradidactic books. The students were separated into two groups and had the same teacher in each class. The basic difference was in the fact that one group would be evaluated by their presentations, and the other by tests regarding the books proposed by the teacher. At the end of the process, some students were selected and brought together in a debate about the nature of science (NOS), which had as its main theme the proposed questionnaire by M.Clough (2008). After the debate was transcribed, a discourse analysis was performed (Martins, 2007). We observed that the students who studied the books had a better understanding of the NOS, but did not demonstrate enthusiasm toward the learning process, unlike the students working in groups who demonstrated motivation but did not present a satisfactory understanding of the NOS. Hence, we demonstrate that these methodologies cannot be used separately, as they form a collective of attitudes to be used by teachers, assuring that the HPS, aside from its motivational aspects for the student, can also contribute to the accurate understanding of the NOS.

Session Title: Ways of Teaching

THE EMERGENCE OF MEDICO-PEDAGOGY IN FRANCE AND ITALY AT THE TURN OF THE TWENTIETH CENTURY

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Abstract

Throughout the mid-nineteenth century, before the education of all children was regulated on a national scale, new legislation promoted the establishment of state schools for the deaf and the blind, most notably in Denmark Finland, Belgium, Netherlands, and France. Although it was only in some of these countries that universal compulsory education became a pressing topic, at the turn of the twentieth century all of Europe saw a huge increase in congresses on educational theory, child welfare, and child psychology. These events promoted a new range of practices, many of which addressed children who were said to be unable to follow education in its regular form and those assigned to categories such as the mentally retarded, the backward, deaf, or idiots—all of them defined as “abnormal.” Doctors, teachers, jurists, and psychologists competed to offer suggestions, methods, and views of a future continued expansion of educational techniques directed at greater autonomy and participation for these children once they had become members of society. In their publications, they appropriated, negotiated, and displaced scientific conceptions to frame their own expertise in the best light.

Focusing on the case of deafness in France and Italy at the turn of the twentieth century, this paper will address how doctors defined a predominant role for themselves in the evaluation of children’s needs and capacities. The definition of a “educational hygiene” allowed to blur the frontiers between medicine and education, and brought the notion of a pedagogical hygiene of the normal human being to the fore. But while offering their specific expertise to pupils who could not follow regular schooling, physicians and psychologists soon built a radical division between normal and abnormal pupils, and used that division to define the scientific criteria governing social, medical and educational expectations of children.

Session Title: Ways of Teaching

A HISTORICAL APPROACH TO PROBLEM-SOLVING STRATEGIES: THE ATWOOD MACHINE AND THE INCLINE

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Abstract

Problem-solving strategies have not been a topic of research in History of Science. On the one hand, problem-solving reflects an understanding of a theory, by means of its application to phenomena. On the other hand, 'problem-solving strategies' is a significant topic in science teaching for several reasons, one of them being that students' careers depend on their skill to solve problems. In the present paper, two typical problems in introductory courses of mechanics – the inclined plane and the Atwood machine – are addressed. Firstly, an account of the solving strategies of these problems in textbooks of the eighteenth and nineteenth century is given (Desaguliers (1719), Kater and Lardner (1830), Gravesande (1747), Rutherforth (1748), Gibson, R. (1755), Rowning (1779), Atwood (1784), Helsham (1793), Adams (1794), Wood, J. (1796), Emerson (1800), Avery (1885), Lodge (1885), Lommel (1899), Crew (1900)). Secondly, solving strategies in contemporary textbooks are presented (Westphall (1959), French (1971), Kleppner and Kolenkow (1976), Hestenes (1987), Halliday, Resnick and Walker (1993), Hecht (1994), Fishbane, Gasiorowicz and Thornton (1996), Bergmann and Schaefer (1998), Dransfeld, Kienle and Kalvius (2001), Serway and Jewett (2004), Cutnell and Johnson (2006), Fließbach (2007), Tipler and Mosca (2008), Strauch (2009), Kuypers (2010)). Thirdly, a comparison and discussion of the different problem-solving strategies takes place. This part also includes Poggendorff's experiments with an Atwood machine and modern versions of these experiments (Poggendorff (1853, 1854), Mach (1912), Hanson (1958), Newburgh, Peidle, Rueckner (2004), Graneau and Graneau (2006), Coelho (2013)). Finally, educational implications concerning the meaning of the fundamental equation of mechanics and problem-solving will be drawn.

Session Title: Ways of Teaching

COMTE'S POSITIVIST DOCTRINE AND REFORM OF SECONDARY SCIENCE EDUCATION IN NINETEENTH-CENTURY BRAZIL

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Abstract

One can identify several transnational movements in which educational and scientific ideas originating in Europe and the United States were introduced into nineteenth-century Brazil. Foremost among the foreign systems of thought was the Positivist philosophy of Auguste Comte. The positivist doctrine, developed in France by Comte and his disciples in the 1830s and first disseminated in Brazil in the 1840s, exercised a significant influence on the superior institutions of engineering and medicine and the military academy from 1880 to 1930. Comtean positivism also influenced secondary education, as evidenced in the curriculum and course syllabi of the Imperial College Pedro II, founded in 1837 in Rio de Janeiro as a model for secondary institutions throughout the country. This paper discusses the influence of the Positivist Philosophy on the teaching of science in the National Gymnasium, formerly the College Pedro II. With the proclamation of the Republic in 1889 and the subsequent educational reform of Minister Benjamin Constant in 1890, the curriculum of the college, and in particular the teaching of the sciences, was profoundly affected by the positivist ideas of Comte. An analysis of the programs of scientific studies adopted in the Gymnasium from 1890 to 1900 demonstrates that these were organized in accordance with the hierarchy of abstraction of human knowledge proposed by Comtean paradigm. Also, course syllabi and textbooks, the most significant being the *Traité philosophique d'astronomie populaire* authored by Comte, espoused positivist principles. The paper examines the changes undergone by the science program and the content of the textbooks adopted in the science courses during the 1890-1900 period, which many consider to be one of the most innovative decades with respect to science education reform in the college.

Session Title: Earth and Sky — Perspectives on Astronomy and the Earth Sciences

DUTCH SKIES, UNIVERSAL LAWS: THE CREATION OF BUYS BALLOT'S LAW IN METEOROLOGY

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Abstract

What does it take for a local empirical rule to become a law of nature? Or who decides to turn a generalization into a law of nature? In the late 1840s Buys Ballot effectively changed the Dutch atmosphere into an experimental field through his creation of a network of meteorological observatories. Ten years later he proposed a relationship between the differences in pressure in the Dutch atmosphere and the resulting winds. After another ten years his rule of thumb was transformed into a universal law of nature, internationally referred to as "Buys Ballot's Law". The shift in emphasis from Dutch skies to the global atmosphere was not a matter of simple generalization and acceptance. The new designation as a general law was in fact largely motivated by specific British concerns. Buys Ballot's ceaseless efforts to internationalize himself contributed substantially to the process. In line with the theme of the conference, this paper shows how the reception of Buys Ballot's law was inextricably bound up with the making of the science of meteorology.

Session Title: Earth and Sky — Perspectives on Astronomy and the Earth Sciences

THE MANILA OBSERVATORY AND THE PHILIPPINE METEOROLOGICAL OFFICE (FROM PRIVATE TO PUBLIC SPHERES)

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Abstract

On the second half of the XIX Century Jesuits made important contributions to the development of earth sciences. Specifically, Catalan Jesuits working in the Spanish colonies of Cuba and Philippine islands played a key role in the development of tropical meteorology. They contribution to the early understanding of structure and behaviour of tropical cyclones and their forecasting was a bold one. Key names of these developments were Benet Viñes, Frederic Faura and Josep Algué. Of our interest, they were responsible for the important geophysical and astronomical observatory at Manila, Philippines.

Faura and Algué, directors of the Manila observatory, were responsible for the creation and development of the first Philippine (and Spanish) meteorological Survey. Strongly devoted to tropical storms forecast, it showed much more vitality and strength than mainland Spain equivalent. It became a reference institution on the far East. These facts were acknowledged by the American government when, after assuming the protectorate and administration of Philippine islands in 1898, it confirmed the management of the new Philippine Weather Bureau (intended as a replica of the US Weather Bureau) to the Jesuits of the Manila Observatory and Algué as its director.

Thus, its “status quo”, as a government technical office managed independently by a religious order, recognized by both colonial powers, Spain and USA, is quite unique and it is a case word to study. This arrangement continued up to 1945 when the new Philippine Weather Bureau was directly organized by the independent Philippine government.

The Philippine Weather Bureau developed as a powerful center under USA ruling, taking responsibility for the weather forecast and meteorological and geophysical studies in a large area of the Pacific Ocean reaching the Marianas Archipelago. This study aims to evaluate the importance of the research and developments made at the Philippine islands.

Session Title: Earth and Sky — Perspectives on Astronomy and the Earth Sciences

VISUAL COMMUNICATION IN EARLY MODERN METEOROLOGY

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Abstract

Weather matters, and it did in the Early Modern Era as well. In the 16th and the 17th centuries, the causes and forms of expression of various weather phenomena were discussed within various traditions: the Aristotelian, Paracelsian, Cartesian, and the Early Modern Empirical Traditions of natural philosophy. While the transmitting information was for the main part textual, visual communication could not be neglected within any of the traditions. Especially discussions on the so called strange weather phenomena (such as rains of blood or armies fighting on the sky) were transformed at the crossroads of textual, visual and oral traditions of the time. This paper discusses some examples of the influence of visuality and visual communication within early modern natural philosophical community of the time. This is a field where the unknown intermingled with the known, and the routine with the unexpected. The ways of discussing strange weather phenomena were often dependent in visual characterisations, whether produced by the popular press as images or the scholarly world in their textual tradition. In this paper, the visual communication of early modern science is discussed in the context of its early modern proponents.

Session Title: Earth and Sky — Perspectives on Astronomy and the Earth Sciences

THE OBSERVATORY OF INFANTE D. LUIS: THE METEOROLOGICAL AND GEOPHYSICAL CENTRE IN PORTUGAL AT THE SECOND HALF OF 19TH CENTURY

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Abstract

The mid-19th century Europe witnessed the creation of meteorological services devoted to the study of atmospheric phenomena, associated with central observatories and national networks – such as the Royal Observatory in Brussels (1831), the Meteorological Institute of Berlin (1847), the Meteorological Department of the Council for Trade (1854), the Central Meteorological Institute in Utrecht (1854) and the Paris Observatory (1856).

The creation of the Meteorological Observatory of Infante D. Luis in 1853 points out Portugal integration, at least initially, in this international feature. Unlike most of those services, the Observatory was created within the Polytechnic School of Lisbon, a teaching and research institution. However, the Observatory assumed functions as a national meteorological service: first by developing systematic meteorological and geophysical observations since 1854, then by creating a national network for observations and gradually by developing research studies in geomagnetism, solar activity and weather prediction. Since 1857, the Observatory was also integrated in an international network for exchanging data, knowledge, techniques and instruments. In the first part of this paper, I will present the creation of the Observatory as a result of the initiative of Guilherme Pegado (1803- 1885) supported by an international community of experts. Then, I will develop the Observatory's activity as a centre of national meteorological and geophysical services in the second-half of 19th century. Finally, I'll analyze how certain facts have combined to prevent this 'natural candidate' to become the official weather service in Portugal in the beginning of the 20th century. This is a key moment for the history of meteorology in Portugal but also for the Observatory, which enters in a growing decay during the next three decades.

Session Title: Earth and Sky — Perspectives on Astronomy and the Earth Sciences

ARCTIC 'MIRAGES' IN THE ACCOUNTS OF NINETEENTH-CENTURY POLAR EXPEDITIONS

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Abstract

This paper discusses the different meanings given to 'mirages' or 'visions' in the travel narratives of nineteenth-century polar expeditions. The arctic expeditions were celebrated as great media events. Although the expeditions took an increasingly scientific character, it was customary to publish after the return a general travel narrative with the double ambition of contextualising the findings as well as promoting them before a larger audience. The narratives refer to the hardships of the crew when traversing for months a barren arctic landscape. The monotonous environment was often juxtaposed with descriptions of curious sensory illusions which the infinite white sceneries inspired in the observer. Such passages, by reinforcing the exotic and romantic image of remote polar areas as a land of mystery and magic, were clearly included for entertainment and popularisation purposes and aimed at attracting a wide audience. The aim of this paper, however, is to discuss whether they could also attain meanings that were more closely attached to scholarly argumentation. The passages partly drew attention to challenges which the harsh conditions posed for the senses and observation work, and these trials were part of the praise of the heroic polar explorer. At the same time, it appears that they should not always be overlooked merely as a literary devise making use of the ordinary topos of polar imagery. The mirages could even support certain scientific claims. The examples will be taken from Nordic expeditions and especially certain investigations related to the phenomenon of aurora borealis.

Session Title: Earth and Sky — Perspectives on Astronomy and the Earth Sciences

JOSEPH FRAUNHOFERS SOLAR SPECTRUM WITH DARK LINES - COMMUNICATION OF A NEW CELESTIAL "LANDSCAPE"

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In the year 1817 the optical engineer Joseph Fraunhofer published in Munich, Bavaria an article about the further improvement of telescopes. It is famous until today because it included a copper etching of the solar spectrum with more than 350 dark (absorption) lines, drawn and etched by Fraunhofers own hands. This etching, published in black and white, but also hand colored versions of it (three original ones are existing and will be discussed) became an almost mythical picture - after the beginning of spectral astrophysics from 1859 on. In this year the physicist Gustav Robert Kirchhoff together with the chemist Robert Bunsen solved the puzzle of this secret code of stars. The new celestial landscape of dark lines - in the Harvard classification from the 1880s soon thousands of different line pictures - was totally different from the standard celestial image which dominated classical astronomical research. These were star maps with thousands of points, showing - exclusively - the exact locations and (in some few cases) movements of distant suns. This may be the main reason (among some others) why it needed more than 40 years after 1817 to solve the puzzle of Fraunhofers lines. And even after 1859 the overwhelming majority of astronomers, e.g. in Germany, did not accept this new landscape as a seminal field of research.

There exists an interesting cultural analogy with the also revolutionary landscape painting as (an now main) interest for painters, which started from Romanticism around 1800 and gained more and more importance until Impressionism in the 1870s. The concept of nature now was changed by the "prism" of the artists` new interests in light and shade, colors and lines.

Session Title: Earth and Sky — Perspectives on Astronomy and the Earth Sciences

HABSBURG CARTOGRAPHY WITH FRENCH SCIENTIFIC FLAIR: THE EXAMPLE OF THE 18TH CENTURY FERRARIS MAPS

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Abstract

At the end of the 18th century, Empress Maria-Theresa of the Habsburg Empire commissioned a large-scale map of the Austrian Netherlands, one of her dominions that coincided more or less with the current territory of Belgium. The artillery corps of the Austrian Netherlands, under the guidance of its director-general, count de Ferraris, carried out this mapping project between 1770 and 1777. Its end products were twofold: first, a very detailed manuscript map (1:11,520), entitled *Carte de cabinet*, which was reserved for use by the imperial cabinet; second, a smaller-scale engraved map without military details (1:86,400), known as the *Carte marchande*, which was intended for sale to a larger audience.

Ferraris's mapping project is a good example of the extensive surveys by specialist engineers that started to emerge in the 18th century, associated with the transition from siege warfare to a more extensive kind of military campaign. This branch of mapmaking was characterized by its use of more accurate surveying techniques with specialized instruments and its uniformity in style and content. Common cartographic practices were disseminated through newly established academies and internationally circulating textbooks, leading to the gradual development of an international, scientific cartographic language. France played a particularly prominent role in this process, by steadily promoting geodetic research and becoming the first country where a truly scientific map of the entire territory at a scale of 1:86,400 was made between 1750 and 1786 under the direction of Cassini de Thury. As the cartographic front-runner, the French example influenced many other extensive mapping projects and the Ferraris maps are no exception. My paper will focus on this exchange of cartographic knowledge across international borders by looking at the specific ways in which Ferraris either meticulously followed French conventions or conveniently adapted them to his own needs, while also investigating his motives for doing so.

Session Title: Earth and Sky — Perspectives on Astronomy and the Earth Sciences

TWO AMATEUR ASTRONOMICAL SOCIETIES AT THE END OF THE 19TH CENTURY

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Abstract

Astronomical research suffered a profound transformation during the 19th century. Publicly funded institutions and professional astronomers replaced private individuals with both financial means and free time as the main force behind astronomical research and development. This implied a redefinition of the relationship between professionals and amateurs, as well as the main research interests of the two communities. Simultaneously a number of astronomical 'amateur' societies appeared both at local and national levels to cater for the needs of a growing number of astronomy enthusiasts.

To examine the amateur astronomical community at a time of transformation, assess its contribution to the development of astronomical research and evaluate differences, due to distinct cultural contexts, we analysed the organisation, membership and scientific output of two societies: the Société Astronomique de France (SAF) and the British Astronomical Association (BAA).

In this paper we characterise the societies membership, number, gender, occupation (professional astronomers will be singled out) and nationalities. Evaluate individual members commitment to research and the societies scientific output via their publications. Study the relationship and communication between professional and amateur astronomers both within the societies and at large.

A better understanding on the development of amateur astronomy in the late 19th century will further our understanding of the impact increased professionalization had upon past scientific research while helping to better steer present day initiatives involving amateur and professional communities.

Session Title: Earth and Sky — Perspectives on Astronomy and the Earth Sciences

EISINGA'S CEILING: THE CONSTRUCTION AND RECEPTION OF THE LARGEST PLANETARIUM OF THE EIGHTEENTH CENTURY

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Abstract

In the late eighteenth century Eise Eisinga (1744-1828), a Dutch artisan, built the largest planetarium the world had ever seen in the ceiling of his living room. It took him some seven years to finish his ambitious project. When he was literally putting the finishing touches to it, news of the planetarium broke in Franeker, the small university town he lived in. Within months Jean Henri Van Swinden (1746-1823), a central figure in Dutch academic life, would publish a wide read description of it. The planetarium and its description made Eisinga a local celebrity.

Today Eisinga's planetarium is still the one of the best visited attractions of the whole region. In the meantime Van Swinden's account was followed by many pamphlets, booklets and commemorative publications. Likewise the actual gearing and clockwork of the planetarium have been studied to great detail. The current custodians are preparing a bid to have it included on the UNESCO world heritage list. This paper will report on the progress of new historical, technical and scientific research these preparations have triggered.

Over time a strong historical narrative on Eisinga and his planetarium has been created. Eisinga is almost exclusively portrayed as a lone, scientific genius, who made his planetarium to counter superstition and ignorance. How does that narrative hold up against newly found archival sources? And what can a reappraisal of the actual 'artefact' teach us? The main focus of the paper will be on naissance and construction of the planetarium on the one hand and on the Dutch and European reception of it on the other. Both have not yet been systematically studied, while they offer some unique insights into the world of astronomy and mathematics of Eisinga's time.

Session Title: Earth and Sky — Perspectives on Astronomy and the Earth Sciences

THE *ANUARIO* OF THE NATIONAL ASTRONOMICAL OBSERVATORY OF MEXICO: A PUBLICATION FOR THE WORLD

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Abstract

The National Astronomical Observatory of Mexico (OAN) was inaugurated in 1878, with Ángel Anguiano appointed as director. Since the first years, Anguiano felt the necessity of establishing communication and exchanging relationships with other observatories around the world. To achieve his goal, he initiated an intense correspondence interchange and made use of several OAN's publications, but mainly the *Anuario*, to establish an exchange deal of OAN's printed materials for other observatories publications. This strategy made possible for the OAN to join up the international astronomical community networks of circulation and communication, and was also a key to swell the OAN's library collection, which had a high symbolic value in Anguiano's discourse.

In this presentation I will examine the strategy Anguiano developed in the first twenty years of OAN's existence to actively participate in the networks of circulation and communication of the international astronomical community. I will also analyze the role the *Anuario* had in this this strategy (despite the role that was formally assigned to it), the extension of this network and the changes it suffered in time. With all this elements I intend to show an approach to the landscape of late 19th century international astronomical community network of communication and the OAN's place on it.

Session Title: Mathematics in Place — 18th, 19th, 20th Centuries

ALGEBRA IN PORTUGUESE JESUIT COLLEGES, 1692-1759

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Abstract

In 1692, the general of the Society of Jesus, Tirso González, ordered a major reform of the teaching of mathematics in the Portuguese colleges of the society. Among other innovations, he prescribed the teaching of algebra for advanced students. This was probably the first time that algebra was taught in Portugal in an "academic" setting, at least on a regular basis.

There is not much information about this teaching of algebra, up to the expulsion of the Jesuits in 1759. However, there is some information, which has not yet been fully explored: González's original ordinance, which requires a close and contextualized reading; some theses, mostly from the Évora college, which address or touch on algebra, and from where it is possible to identify probable sources (textbooks used); and a textbook published in 1754-56 by the Jesuit Ignacio Monteyro, which includes a chapter and some comments on algebra.

From an analysis of these documents emerges a picture of evolution during these decades, from an oddly outdated cossic algebra to forms of specious algebra, but never giving algebra and algebraic language the central role it often had in central European pure mathematics at this time. Applications to geometry (analytic geometry) do not appear. Thus, it seems that Portuguese Jesuits clung till the end to a classical view of mathematics where algebra played a secondary role.

Session Title: Mathematics in Place — 18th, 19th, 20th Centuries

ACTUARIAL CALCULUS IN PORTUGAL FROM THE LATE 18TH CENTURY UNTIL THE LATE 19TH CENTURY: AN OVERVIEW

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Abstract

The first Portuguese life assurance companies were created in 1835 and 1845 – *Fidelidade* and *Providência*. The first Portuguese pension funds appeared with the so called *montepios de sobrevivência*, mutual benefit societies which main assistance was providing survivorship pensions to the widows/heirs of their members. *Montepio Geral*, created in 1840, was the most prosperous of the later associations and still exists. During the 19th century, the foundations on which both kinds of institutions were settled were scientifically incorrect and most of them disappeared. As for life assurance companies, it seems that it was not until 1907 that life assurance coverage was systematically applied, with the approval of a new regulation for the insurance industry, and only after 1920 it would have assumed considerable importance.

In this presentation we refer some contributions in the use of Actuarial Calculus theory in Portugal, since the late 18th century until late 19th century. José Maria Dantas Pereira (1772-1836), mathematician and naval officer, translated the first Portuguese text about life annuities, published in 1797, from a French text, authored by Paul-Edme Crublier de Saint-Cyran (1738-1793?). Luís Feliciano Marrecas Ferreira (1851-1928) was the first teacher of actuarial topics in Portugal, which began in 1886 in the *Instituto Industrial e Comercial de Lisboa* (Industrial and Commercial Institute of Lisbon). Between the two, we distinguish Claúdio Adriano da Costa (1795-1866), because of its relationship with the two life assurance companies, *Fidelidade* and *Providência*. We also mention the contribution of Daniel Augusto da Silva (1814-1878), aswell a mathematician and naval officer, in the study of the financial stability of the Portuguese *montepios de sobrevivência*, in particular the *Montepio Geral*. Unless for the contributions of Daniel da Silva, the references we make are unstudied topics of the History of Actuarial Calculus in Portugal, an area that still remains to be studied.

Session Title: Mathematics in Place — 18th, 19th, 20th Centuries

GAUSS AND TARTU UNIVERSITY

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The King of mathematicians, Carl Friedrich Gauss had an active correspondence with colleagues at the University of Tartu (then Dorpat). The highlight of this relationship came when the astronomer Johann Wilhelm Andreas Pfaff left Tartu in 1809. The Rector of the university Georges Frédéric (Georg Friedrich) Parrot tried to persuade Gauss to become Pfaff's successor. Gauss did not accept the offer for the reason that at the time mathematics and astronomy were the field of only one Professor in Tartu. That would have meant the necessity for Gauss to give all the lectures in both fields and mostly to beginners. Not enough time would have been left for his original research in mathematics. The support to the family was also not at the same level in Tartu as in Göttingen. But Gauss and Parrot remained in contact. The correspondence was even much more intensive, however, between Gauss and the famous Tartu astronomer Wilhelm Struve. Almost at the same time Struve began surveying the Baltics and Gauss began surveying the Kingdom of Hanover. Struve and Gauss exchanged many letters, 22 of which still exist. They mostly exchanged surveying results but astronomical data as well. In one of his letters Gauss explained Struve the heliotrope, an instrument he himself had invented. Struve was impressed by the invention and ordered several to his surveying team. Gauss corresponded with several other mathematicians and astronomers that were active at the University of Tartu in the nineteenth century. Martin Bartels, a friend of Gauss since primary school, is perhaps the most well-known of them. These connections will be briefly addressed in the paper.

Session Title: Mathematics in Place — 18th, 19th, 20th Centuries

A FORERUNNER IN ALGEBRAIC STRUCTURES, BEPPO LEVI (1916)

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Abstract

The aim of this work is to show the algebraic contents in *Introduzzione alla analisi matematica. 1 Teorie formali* published by Beppo Levi in Parma in 1916, which is a forerunner of the abstract algebra. At that time, algebraic topics were studied as preamble of Calculus, as part of Mathematical Analysis. Levi incorporates new concepts and approaches in his textbook in a time of transition towards the algebraic structures. *Introduzzione* comprises eight chapters; each one is divided in two parts, the first one, theory and the second one, examples and complements. We will consider the chapters related to matrices, determinants and linear systems in terms of modules and algebras.

Session Title: Mathematics in Place — 18th, 19th, 20th Centuries

THE CIRCULATION OF MATHEMATICS AND PHYSICS IN COLOMBIA AT THE END OF THE 19TH CENTURY

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Abstract

In 1887, was created the *Sociedad Colombiana de Ingeniería* (Colombian Society of Engineering) and the same year was published the first issue of its journal: *Anales de Ingeniería* (*Annals of Engineering*). Through this publication we can read the desire of the Colombian engineers to promote sciences in the country and at the same time their necessity to gather to give more weight to their corporation.

The *Anales* were orientated towards both “Pure Science” and “Applied Science”. The aim of this talk is to extract publications related to Physics and Mathematics from the first eleven volumes 1887-1898, and analyse them by taking into account technical details and their impact on the scientific Colombian community. We will also consider works related with educational issues.

Session Title: Mathematics in Place — 18th, 19th, 20th Centuries

SHAPING A PASSAPORT FOR A SPECIALIZED WORLD: SOME THESES OF MATHEMATICS IN BRAZIL (1930-1970)

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Abstract

The studies, diffusion and teaching of mathematics in Brazil were restricted to engineering schools until de 1930's, when the first undergraduate courses of mathematics and physics were created. This characteristic of the Brazilian case implied the coexistence of mathematics with physics and engineering in all periodicals dedicated to exact sciences until the first decades of the Twentieth Century. In this context, practicing mathematics was an activity quite related to engineering.

This picture of the scientific field changes in the thirties, when rites of passages and other cultural practices are created or modified by the first Brazilian professional mathematicians to produce a differentiation from engineers and physicists.

In this talk, we would like to analyze the theses written in the Faculty of philosophy, sciences and literacy of University of São Paulo from 1930 to the end of the 1960's. With this corpus in mind, we intend to pursuit the first movements of this new research community to constitute not only the access rules for their academic titles but their canonic authors and practices of reading.

Besides, computing the co-citation of some authors in the references of these theses we drew a first draft of circulation of mathematical texts in this emerging community.

Session Title: Conceptual Issues in Mathematics

(SPANISH) ANCIENT HISTORY OF FUZZINESS

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Abstract

One of the first Hispanic scholars giving notice of new currents was Juan David Garcia Bacca (1901-1992), who in 1936 published his *Introduction to modern logic*, a work praised by I. M. Bochenski (1902-1995) and Heinrich Scholz (1884-1956). Later attempts of many eminent teachers, between them Alfredo Deaño (1944-1978), Manuel Sacristán (1925-1985), Javier Muguerza (1936-), Jesús Mosterín (1941-), Javier Echeverría (1948-), Lorenzo Peña (1944-), Javier de Lorenzo (1939-)…, very often clashing against a conservative society, nothing conducive to new ideas.

One good initiative has been the creation, in the mining Asturian town of Mieres, a `Research Center for Soft Computing´, initially around Enric Trillas (1940-), considered the introductor of Fuzzy Logic in Spanish curricula. It has attracted many international researchers, such as the Japanese Michio Sugeno. His themes are very broad, but ever around fuzzy methods as well as its philosophical implications.

Another Spanish author who has been reporting these new streams of logic is Julián Velarde (1945-), with its paper “Lógica Multivalente”, or *Formal Logic,* that belongs to his *History of Logic,* in four volumes. Also of interest may be his *Gnoseología de los Sistemas Difusos,* on philosophical connections of these issues.

New research groups have been formed in recent times. CSIC in Barcelona, led by Lluis Godó and Francesc Esteva; or Granada University, headed by Miguel Delgado Calvo-Flores; or the UPNA, led by Humberto Bustince.

Finally, we indicate oldest Spanish contributions to basis for MVL and “future contingent” problems; so, by Raimundo Lulio (Raymond Lully, 1232-1315); or the famous polemic “De Auxiliis”: Luis de Molina (S.I.) vs Domingo Báñez (O.P.); the works of Francisco Suárez (S. I., 1548-1617); Juan Caramuel (1606-1682), …

Session Title: Conceptual Issues in Mathematics

HOW MATHEMATICS CONFRONTS ITS PARADOXES

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Abstract

Paradoxes in mathematics such as the *casus irreducibilis* (Cardano 1545), the paradoxes of the calculus (Berkeley 1734) or Russell's paradox (Russell 1903) show surprisingly many common features. Therefore it is important to understand these paradoxes in a historical perspective as linguistic phenomena occurring at a specific stage in the development of the particular theory. It seems that even though each paradox taken in isolation is well understood, the paradoxes as a general phenomenon still lack sufficient historical analysis. In the paper we would like to analyze the historical development of the languages of the particular mathematical theories (i.e. algebra, calculus, predicate logic) as ***means of communicating mathematics***. We will argue that the paradoxes are connected with a specific phase in the historical development of the particular language; we will characterize that stage as the stage when the particular language begins to construct representations of representations and we will show that the paradoxes represent the boundaries of the language (Kvasz 2008). That is why the paradoxes exhibit several common features, which we will try to analyze. The paper can be seen as a contribution to the cognitive approach to the history of mathematics, as was proposed, among others, by Raviel Netz.

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Session Title: Conceptual Issues in Mathematics

INDIAN LOGIC AND FUZZY LOGIC

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Abstract

In 1993, the American engineer, Bart Kosko, published a controversial book: *Fuzzy Thinking. The New Science of Fuzzy Logic*. He explained in his work why Fuzzy Logic expanded as rapidly by Asia; much earlier and more efficiently than in the United States of America and Europe. Kosko attributed this circumstance to the fact that in Asian countries, China, Japan, Korea, etc, Buddhist thought - traditionally rooted in this region - is more prone to this kind of logic, because it admits the contradiction as a legitimate element their reasoning.

However, the conceptual origin of this logic is found in the West, although has been in the East that their applications in the areas of technology and artificial intelligence have been carried out more diligently and noticeably.

In this paper we try to explore this question by examining what aspects of Buddhist speculative philosophy is consistent with the principles of Fuzzy Logic, and why Buddhist logicians were not the first to create a logic of this kind.

Session Title: Conceptual Issues in Mathematics

TRANSMISSION, INTERPRETATION AND EDITORIAL CHOICES: THE CASE OF A CHINESE MATHEMATICAL PROCEDURE

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Abstract

Recent studies in Sinology have shown that Qing dynasty editors acted as philologists. This paper argues that the identification of their philological methods and editorial choices suggests that their choices were not totally neutral and may have significantly shaped the way modern historians interpreted specific works edited by mathematicians of that dynasty.

A case study of the re-edition of 1798 of a Song dynasty treatise by a Qing dynasty mathematician will illustrate this point. At the end of the 18th century, Li Rui (1773-1817) was asked to prepare an edition of the mathematical works written by Li Ye (1192-1279) for a private collection. Li Rui was a talented mathematician, but he was also a meticulous editor and trained philologist. Li Rui made some corrections to the available texts of his time in an effort to restore an older version of Li Ye's treatises that had been lost. Convinced of the Chinese origin of algebra, Li Rui used philological techniques to recover the lost materials and to restore the roots of "Chinese mathematics". His corrections were directed by his specific interpretation of Li Ye's famous mathematical procedure, the procedure of Celestial Source (*tian yuan shu*). Today, the Celestial Source characterizes "Chinese algebra", and Li Ye's works portrays it. However, the specific concerns of Li Rui about the procedure of Celestial Source, combined with his editorial methods, contributed to this perspective.

Session Title: Medicine and Society in the Contemporary World

THE EXPERT ROLE OF SCIENTISTS AND MEDICAL SPECIALISTS IN RUSSIAN "ATOMIC CLOSED CITIES"

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Abstract

The peculiarity of closed cities involves the secrecy order, atomic production, high technology abundance. They are called "satellite towns" and situated near the regional centres. On the one hand they use its science resources; on the other hand they serve, first, as an original laboratory, a scientific-technical research ground and, second, as a branch of universities. The strategic nuclear research are first-priority here. Only recently nuclear medicine begins to develop. Here are some negative consequences of the secrecy order to science: the natural circulation of scientific knowledge is decelerating, interdisciplinary and interprofessional communication is being restricted, public discussions are not allowed. In such a situation the role of the personal contact of scientists and medics is growing in order to form new scientific interests and knowledge circulation. There are two periods in the history of such cities: 1) the Soviet period – the nuclear-weapons production; 2) the post-Soviet one – the reactor shutdown, the "atoms for peace" reorientation, the development of substitute production in terms of basic technology.

In the Soviet period the risk expertise of atomic production and of its consequences to health was closed, politically committed and loaded. It did not give an idea about the object. Scientists and medics were to image safely atomic production, however medical practice results suggested otherwise. That is why along with the official "evident expertise" the "implicit" or mediated one was coming into existence, which was manifested in the appearance of new trends, laboratories, technology connected with the research, first, of the high-radiation consequences and, second, of the application of the radionuclide pharmacology in diagnostics and medical treatment. The new object was integrating scientists of various academic disciplines in the regional university centre. Eventually new research institutes were founded: genetics, pharmacology, oncology ,cardiology (for example in Tomsk).

In the post-Soviet period public discussions along with the independent expertise were arising, and scientists and medics were taking part in such kind of appraisal. They were exploring the object systematically taking into consideration dynamics, contingency and ambiguity. As a result interdisciplinary contacts in science and medicine were coming into being.

Session Title: Medicine and Society in the Contemporary World

SOCIAL AND BIOMEDICAL INFLUENCES ON THE EMERGENCE OF RISK FACTORS IN PREVENTION OF CORONARY HEART DISEASE

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Abstract

The rise of coronary heart diseases (CHD) and other chronic diseases led to greater recognition of the inapplicability of the cause-effect models based on laboratory experiments involving bacterial diseases. A more suitable conceptual framework was correlation, a new method of finding associations rather than causes. Correlation was one of the most important new scientific concepts in the twentieth century and greatly expanded the statistical methods that could be used to study the causes, prevention and treatment of disease. The growing interest by chronic disease in USA led to the application of epidemiologic methodology to the study of CHD—in 1947 the U. S. Public Health Service undertook planning for the Framingham (Massachusetts) Heart Study as a community epidemiological study and in 1949 assigned it to the newly created National Heart Institute.

But the term risk factor first appeared only in study publications in 1961 as 'factors of risk' or 'risk factors' that could be identified by the practicing clinician. Why did this concept of 'risk factor' emerge in the sixties? And why was it so well accepted? As a conceptual schema, one might think that the complexity and uncertainty of a probabilistic, multifactorial model of disease would have prevented the widespread acceptance of risk factor ideas and practices. On one hand, the risk factor approach embodies highly valued aspects: precision, specificity, quantification, and individualism (which in this case are rationalized and legitimated–paradoxically–by aggregate data and thinking). On the other, there are close resemblances between the risk factor model and the widely held belief that an individual's genetic predisposition, environment exposure, and lifetime of behavioral choices should affect his/her health.

I will examine the duality of social and biomedical influences as well as its interaction applied to CHD and how, from this dialectic, emerged the risk factor approach.

Session Title: Medicine and Society in the Contemporary World

MASS ANTICHOLERA VACCINATION IN THE BALKAN WARS 1912-1913: MEDICINE, PUBLIC HEALTH AND SOCIAL CONTROL

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Abstract

In this paper, we are presenting our research on the first –mandatory– mass vaccination program in Greece that took place during the Balkan Wars in 1912-1913. The purpose of the vaccination project was the containment of the cholera epidemic, which outburst at the wide area of Macedonia and threatened to spread. Mass vaccinations of such kind, that were applied a few years later, during the First World War mainly, are considered the main reason of the limitation of epidemics on the frontlines, which was common during previous warfare.

In early 20th Greece, vaccinations -as well as other medical breakthroughs- were being accepted in many different ways by a heterogeneous society; the 'progressive' bourgeois consented, endorsing the Western way of living; on the other hand the large rural population remained confused and reluctant. Under the circumstances, the Press took the stand as advocate of "progress" and denounced "oriental-like" and "slave like" characteristics of the people, who haven't escaped the influence of the regressive Ottoman culture. The political and military authorities, in the context of the 'modernization' of the Greek society, adopts theses new tactics and in many ways they go even further ahead than most European states of the time.

Our approach examines how medicine became an important institution of social control, and how this medicalization of the society took place. Mandatory vaccinations became part of the laws of the state. Doctors and health professionals gained social and political legitimization as experts in matters on public health. The role of the Press in this procedure was also very important; not only had he helped in the legitimization of the vaccination programs, but also legitimized himself as the intermediate between scientists and the public and as a promoter of social progress. Our case-study, situated in the Balkan/Greek locality, is an excellent example of how this process took place in the European periphery.

Session Title: Medicine and Society in the Contemporary World

TAMING FAILURE: SURGERY, BIOMEDICINE, AND THE PROBLEMS OF 'IMMORTALITY' IN TISSUE CULTURE

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Abstract

Failure in science has been discussed as a marginal subject by many scholars, including Thomas Kuhn, Steven Shapin, Gerald Geison, and Peter Galison. By examining the history of tissue culture, this presentation discusses how scientists delineate the category of failure in their experiments. First of all, I will show that the French-American surgeon Alexis Carrel, one of the inventors of tissue culture technique and a Nobel laureate in 1912, defined the category of failure according to his surgical expertise. As he was successful in treating wounds through his utmost care and strict observance of the rules of hygiene and asepsis in surgery, he claimed that he could make his cultured tissues survive through his extreme care and aseptic control of culture environment. This led to his influential claim that cells could live forever in a carefully-controlled laboratory environment. But this claim, which was never challenged for almost fifty years, was rejected by the American biomedical scientist Leonard Hayflick. According to his 1961 paper, every somatic cell should die after a certain number of doublings, no matter how carefully it was cultivated in petri dish. I argue that this limit of cellular life, which was called the "Hayflick limit," was not a dramatic discovery on the truth of the cell, but a reflection of the changed definition of failure in the context of the rising American biomedical enterprise, which made Carrel's definition of failure obsolete. As biomedical scientists of the mid-twentieth century became concerned about the use of normal somatic cells in heavily-funded cancer and virus research, they, including Hayflick, began to regard the eternal life of certain somatic cells as the hallmark of failure, that is, a pathological transformation leading to tumor tissues. This redefinition of failure captures a moment in scientists' persistent struggles to *tame* failure in their research.

Session Title: Medicine and Society in the Contemporary World

THE APOTHEOSIS OF THE OVERLAY: SPECTACLES OF LAYERING & TRANSPARENCY IN 19TH- & 20TH-CENTURY ANATOMY

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Abstract

In a seminal essay, Bruno Latour argues that "There is nothing you can dominate as easily as a flat surface…" Yet, more often than not, a good deal of hard work has to take place in order to produce surfaces that are flat. This paper tells a story of flattening and layering. It focuses on the history of "topographical anatomy"— a tradition of slicing and sawing rather than cutting and carving — and its procedures for converting bodies from three dimensions to two dimensions and back again. In topographical cross-section anatomy, the frozen or mummified body was cut into successive layers that were then transcribed and reproduced as pages of a book or a sequence of prints or slides (sometimes with the original slices preserved as a sequence of specimens for the anatomical museum). The topographical method influenced, and was in turn influenced by, flap anatomy (the technique of cutting out printed anatomical parts on paper or cardboard and assembling the parts into a layered representation of the human body). In the 20th century, medical illustrators and publishers developed a new technique of three-dimensional anatomical layering: the anatomical transparency — an epistemological/heuristic device which, in the postmodern era, has come to enchant artists as well as anatomists. I will argue that these anatomical productions — medical illustrations, artworks, but also, exhibitions, toys, gimmicks, and other objects of consumer desire — are meaningful to us because the oscillation between the dis-assembly and re-assembly of bodies as images and image-objects, rehearses our own ambivalent relation to the anatomical body. It also rehearses (perhaps more mysteriously) our ambivalent relation to the planearity of anatomical images which serve as an effigy of self and other, and to the Flatland universe of planearity in which we imaginatively dwell. This talk features photographs by artist-physician Mark Kessell.

Session Title: Medicine in Global Context

A BIOMEDICAL ENTREPRENEURSHIP IN SOUTH AMERICA: BEHRINGWERK´S BRANCHES AND THE CIRCULATION OF BIOLOGICAL PRODUCTS DURING THE 1930S

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This paper shows how the German firm Behringwerk tried to establish branches in South America from Brazil using the available networks of knowledge and communication of the continent´s German community. The loss of German colonies after the First World War was a huge damage to its chemical industries whose attention turned to South America. The Behringwerk´s products came to Brazil in the 1920s, but considerably commerce began only when the firm was incorporated to the German chemical industries conglomerate (I.G. Farben) in 1929. Representing the conglomerate´s sector for the production of biological products – mostly sera and vaccines – the Behringwerk appropriated the networks of investors and scientist that circulated between Germany and many South America´s countries to establish a branch in Rio de Janeiro in 1932. At that point, the purpose was not selling products anymore, but producing them. Following the new Brazilian inspection legislation from the middle 1920s, the import of biological products became very expensive. In order to maintain the huge incomes with the commerce of sera and vaccines in South America, especially the ones for the veterinary market, Behringwerk began from the city where there were already consolidated contacts with politicians, physicians and public health administrators. Until the creating of the second branch in Buenos Aires in 1938, the Behringwerk distributed its products from Rio de Janeiro to many countries like Argentina, Peru, Chile, Bolivia and Uruguay. By this time, the introduction of German firms was in accordance with the broader German diplomacy which intended to amplify its influence´s area in South America in order to compete with French and North-American initiatives. The chemical industries conglomerate had an especial role in reinforcing the German influence and presence, since its products were disseminated in the South-American markets. In this sense, the distribution of Behringwerk throughout the continent followed previously networks of communication and knowledge circulation.

Session Title: Medicine in Global Context

GLOBAL COMMUNICATION OF VARIOLATION FOR SMALLPOX: FACTORS IN THE 18TH CENTURY

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Abstract

Variolation for immunity to smallpox was an early medical practice which spread from England in 1721 to all countries in Europe during the 18th century by multiple methods of communication. This global diffusion preceded by 75 years Dr. Edward Jenner's wider known method of vaccination initiated in 1796. Jenner had used variolation himself for many years before making an adaptation to the practice. Variolation, so-called from the Latin 'variola' for spots, used pustule matter from one person with smallpox to drop onto a scratch or incision on another, whereas vaccination, from the Latin 'vacca' for cow, substituted cowpox pustule matter as the inoculum. Variolation produced a mild case of smallpox and gave immunity for life. It tends to be overlooked historically but there were multiple influential factors in its global network of communication and this paper gives examples of six: personages, ideas, institutions and several innovations involving a lateral spread of information, all leading to the global adoption of this early inoculation technique which prevented deaths and disfigurements from smallpox and was the effective precursor to vaccination.

Session Title: Medicine in Global Context

CONTINUOUS EFFORT IN KNOWLEDGE MAKING: A NETWORK ANALYSIS OF WHO EXPERT COMMITTEES

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Abstract

The present research about the World Health Organization tends to divide its history into three periods. Firstly, the global diseases eradication programs marked the efforts of its first twenty years. Secondly, the Alma-Ata Declaration of 1978 announced a shift of focus from specific disease control to an overall access to health through primary health care. Lastly, as from end of the 1980s, the financial crisis of the WHO offered opportunities for private sectors to influence the policies. Although periodical division based on declaration and gigantic disease control programs can be tempting, this research sheds light on the continuity of the WHO's knowledge making through the expert committees disregard of its general political declaration.

Expert committees, study groups and panels were advisory devices that were designed to offer external advice on specific problems. The Director General defines the subjects of the expert committees every year under the agreement of the Executive Board. Furthermore, he or she can convene study groups in emergency without agreement in advance. The conclusion of these advisory devices was published into Technical Report Series, and was expected to be circulated worldly. It is fair to put that these experts were endowed with capacity to produce the knowledge that is recognised by the WHO. Hence, it would be crucial to inquire into who were invited and what were their formal positions and their affiliations. In addition, by visualising the expert network of these advisory devices every ten years, this research illustrates that committees are connected into several clusters by common participants despite the differences in terms of timeframe and subjects. Moreover, archives show that a continuous effort made by the experts to establish connections between subjects at hand. Regardless of several alterations of policy focus, this research elucidates the temporal continuity and effects of expert networks in knowledge making.

Session Title: Medicine in Global Context

GERMANY, PORTUGAL, AND BRAZIL CONNECTED: MEDICAL POLICE BY PETER FRANK, FREITA SOARES AND JUSTINIANO FRANCO

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Abstract

The late seventeenth and early eighteenth century treatises on medical police were a modern version of mirror-for-princes (*specula principum*), writings which had as a theme not the sovereignty, but rather, the government of the people. In France, Mahon wrote a treatise about medical police in 1801, and Fodere wrote another one in 1813. Nevertheless the idea of medical police did not bring legitimacy to the authors who defended it after 1815 in France and England. On the other hand, in the Lusophony, the opposite occurred. In the United Kingdom of Portugal, Brazil and Algarves, a treatise on medical police, written by Jose Pinheiro de Freitas Soares, is published by the Royal Academy of Science of Lisbon in 1818. The treatise was voluminous and thorough – so was Johann Peter Frank's colossal *Complete system of medical police*, the first collection of writings about the subject. The expression "medical police", despite the decline of its legitimacy in the liberal France and England, became the element through which Brazilian physicians and surgeons required the State protection. There were not any Brazilian treatises on medical police, but the expression was often brought up by physicians in journals, and Justiniano Melo Franco explained in a few words what it meant in a magazine of Sao Paulo. Justiniano was the son of Francisco Melo Franco, who was a member of the Royal Academy of Sciences of Lisbon in the beginning of the nineteenth century. Could the legitimacy brought by the idea of medical police be a result of a "Luso-Brazilian cameralism"? In other words, was the political economy of Portugal and Brazil decisive to their embracing the German ideas of public health?

Session Title: Medicine in Global Context

IMPERIALISM, PHILANTHROPY, MEDICINE AND SURGERY IN EAST ASIA

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European colonies overseas offered an unprecedented opportunity to meet new conditions in new climates and new cultures increasing the scientific knowledge elaborated in the West through three key moments: the scientific revolution, the French revolution and the industrial revolution. In China and Japan, Western doctors and surgeons favoured and contributed to the spread and transmission of the European enlightened science heritage. This paper deals with on how modern medicine developed especially in the eighteenth century in Europe, and by extension in the American colonies, before arriving and spreading in East Asia in a missionary as well as imperialist context.

We propose how the introduction of surgery and medicine, as instrumental knowledge, served the transmission of Western science in East Asia. It is important to stress the consequences of this interaction between these two different worldviews, the reception of this new knowledge and how it could be articulated within local cultural backgrounds often opposed to the aspirations of modernity and enrolled in an exacerbated nationalism. This communication aims to highlight scientific culture in an enlightened missionary context, and to stress how social control strategies emerged in the beginning of the 20th. Century through philanthropic secular societies that promoted the welfare and the educational models of medical sciences in East Asia.

Session Title: Disease and Cure — Historical Perspectives

AN EVOLUTIONARY PERSPECTIVE ABOUT THE LYMPHOCYTE IDENTIFICATION DURING THE FIRST HALF OF THE XXth CENTURY

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Abstract

INTRODUCTION: New technical advances based on the morphological descriptions realized by Pappenheimer allowed a better characterization of lymphocytes.

OBJETIVES: Report the most important publications about lymphocyte identification during the first half of XXth Century.

METHODS: Searching the term “lymphocyte*” on Pudmed and Scopus, delimiting the historical time.

RESULTS: Lymphocyte identification was made on base to morphological and functional aspects. Pappenheimer (1901) defined the lymphocytes as a particular group of leucocytes that show a determined morphological structure. Ward (1904) recognized two major types: small and big. Harvey, Ross, Norris, Nakahara, Murphy, Taylor and Earle studied lymphocyte behavior against different chemicals and physical agents (X Rays, light and heat). Abramson analyzed electrophoresis migration. Wiseman (1931) determined the maturity criteria for peripheral blood. Miller distinguished between lymphocytes and plasma cells using staining techniques, and Oelkers reported on the proteolytic enzymes. Eric and Harris (1946) and Habel, Endikorr, Bell and Spear (1948) demonstrated that lymphocytes were the antibody producer cells, different than macrophages. However, Fragaeus (1948) thought that this function was executed by plasma cells. In the morphological cytology field, Sundberg reported the morphology and functional dualism (lymphoid and myeloid) in the hematopoiesis. Erich, Drabkin and Forman (1949), evidenced the relationship between antibodies and nucleic acids, supporting Fragaeus’ results.

CONCLUSION: In the first half of XXth Century, lymphocytes were still quite unknown cells that aroused a great interest. At that time, lymphocytes and plasma cells were clearly differenced. Their responses against different stimuli delighted a functional profile that made it different to other blood cells, being recognized as the antibody producer cell.

Session Title: Disease and Cure — Historical Perspectives

AMATO LUSITANO AND THE USE OF HEALING STONES

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Abstract

The use of healing stones in medical therapy dates back to antiquity. Generally its therapeutic value was associated with superstitious beliefs, magic or astrology.

This interest in healing stones was recorded in several works. One of the oldest is attributed to Theophrastus (372 BC - 287 BC), a disciple of Aristotle, who wrote a treaty on mineralogy. Hipócrates (460 a.C. – 377a.C.), Dioscórides (40-90) and Galen (130-200) were other authors who have pointed out the different healing properties of rocks and minerals in their works.

Amato Lusitano (1511-1568), a Renaissance Portuguese physician, refers to the use of some healing stones, including the bezoar in his works.

This study aims to analyze the use of healing stones in the Amato Lusitano's therapy. To collect data we used document analysis of the works of Amato Lusitano, including the Seven Centuries of Medicinal Cures , translated by Firmino Crespo , edited by the Faculty of Medical Sciences, Universidade Nova de Lisboa, in 1980.

One of the stones used in Amato Lusitano's therapy was benzoar. It was a calcareous concretion found in the stomach of some ruminants that was used as antidote to the most varied types of poisoning.

Session Title: Disease and Cure — Historical Perspectives

COMMUNICATING LAY MEDICAL KNOWLEDGE: CONSUMERS AS WITTNESSES IN LAW CASES IN 17TH CENTURY SPAIN

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Abstract

Lay people and consumers of medical services in the past only seldomly communicated deliberately their individual knowledge on medicine. Therefore, historians of medicine are required to resort to rather uncommon types of sources, which, at first glance, do not seem to inform about these voices so difficult to capture. One of these sources, can be found in judicial proceedings of early modern times. In particular, those prove to be of valuable content, in which practitioners of medicine were brought before court and where patients appear as witnesses in the interrogation protocols.

The aim of this paper is to reconstruct the medical knowledge of lay people in Early Modern Spain and especially to analyze the way they communicated such knowledge. Special attention is given to their specific use of categories, concept and language when communicating their perceptions of medicine. In order to illustrate the medical pluralism, consumers of different types of medical attention, the regular as well as the irregular ones, shall be taken into consideration. Thus, the present paper bases its analisis on the one hand on criminal cases from the region of Toledo (1600-1700), in which principally physicians and barber surgeons are accused of unauthorized practice of other medical professions. On the other hand, inquisitory processes of the Tribunal of Cuenca (1610-1715) are included, where suspected jewish physicians and apothecaries, astrologers, witches, healers, and quacks constitute the list of accused practitioners. Using the testimonies of the patients, the study allows to acceed to a broad and divers community of consumers, revealing at the same time their own dynamics of communication.

Session Title: Mind, Science and Medicine

OLIVER SACKS AND THE LEGACY OF WRITING NARRATIVE MEDICINE

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Abstract

The Expert is dead; long live the Pop-Scientist! During the fifth historical development of Professionalizing Popular Science Writing and its institutional process of Public Understanding of Science, communicating science with the wider public beyond the academic field has proven its major impact on societies understanding of how science is done und how it works. Although one cannot deny that Third Culture-Intellectuals being bound together by their literary agent John Brockman have much to do with creating new ideologies occupying the research field of the Humanities instead of making science understandable, many of his Popular Science Writers have established themselves as Masters of Scientific Writing, as the Anglo-American Literary Critique has pointed out. But there is some struggle with the canonizing process which as an instrument of power integrates Science Writers who neither do belong to Third Culture Intellectuals nor are proud of promoting themselves as the great emperors of changing one's life. This is a major problem for those Scientists who have trained their craft of Popular Science Writing within their own struggles with science communities and institutions as well as practitioners of their profession. The American Neurologist and outstanding Science Writer Oliver Sacks has been canonized in that way, but his scientific prose differs most intensive from that of his companions. And it also differs from the writing tradition which was first established and cultivated by Sigmund Freud, whose style of writing first was labeled by the term "Volkspsychologie" (Folk Psychology). Between Literature of Science and Popular Science Writing Oliver Sacks has invented a narrator who tells Short-Stories about the untold life of patients in mental illness and struggle in order to make it livable for their readers. Making understandable scientific history, facts and experimental procedures is just a side-effect, but it never stood in the centre of its writing. Oliver Sacks Legacy of Writing Popular Pathbiographies has shown that the outspoken death of postmodern subject-theory has nothing to do with the reality of a neurologist and its clinical practice. Instead he is celebrating the resurrection of the clinical subject from the realm of his 'Clinical Tales'. The literary form of ‚clinical tales' does not only intend to communicate with a broader audience about the social ‚Otherness', which Neurologists try to cope with behind closed doors. He provokes a confrontation between patients and experts which now has become a major challenge of Narrative Medicine. Furthermore, he familiarizes his colleagues with a non-reductionist approach of doing and writing Science. For his Knowledge of Expertise has been developed by living a certain kind of medical life-form and so it is knowledge of life derived from life itself, the message of his style of writing is: Be a very good Popular Science Writer, in order to become a better Expert!

Session Title: Mind, Science and Medicine

ENDOGENOUS NEURAL ACTIVITY: THE FALL OF THE OLD CONVENTIONS AND THE EMERGENCE OF NEW ONES.

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Abstract

At the beginning of the 21th century came an unexpected discovery presented by Marcus Raichle's team. This discovery, now widely known as Default mode network (DMN), seriously shuddered with some old conventions of neuroscience. Neuroscientists after this discovery crucially updated their knowledge of the brain structure and function and also recognized that they studied the brain only from one side – the side of active stimulation.

Strong convention of 20th – brain is mainly "engine" that works mainly under stimulation and during active tasks – determined the direction of research that aimed for "evoked activity of brain". This line of research almost never considered existence of "endogenous" neural activity that has nothing to do with active stimulation or immediate cognitive responses.

Current research of DMN leads to entirely new knowledge that was not available for the previous research tradition. Old convention of "responsive brain" is gone but new conventions began to emerge. At first the function of DMN was unknown and most scientists talked about it with great caution. At the present time most scientists openly assert that DMN is responsible for self-referential thoughts, mind-wandering, aspects of social brain, etc. This poses a problem because testability of DMN with methods of cognitive neuroscience is impossible. We should look critically on this matter because this self-referential interpretation of DMN can be only a convention without any empirical evidence. This is not the only thing that can be considered as methodological mistake. There are more, for example: nature of "resting state" itself, head-movement during scanning, anti-correlative aspects between DMN and evoked activity, blinking as response to question etc. Reason for these methodological problems is manly non-critical communication between neuroscientists about the nature of rest that has consequence in non-critical acceptance of hypothetical interpretations of function of DMN.

Session Title: Mind, Science and Medicine

THE DIALOGUE BETWEEN PSYCHIATRY, POSITIVISM, AND REPUBLICANISM IN THE WRITINGS OF LUÍS CEBOLA (1876 -1967)

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Luís Cebola (1876-1967) was a Portuguese psychiatrist and prolific writer, having published numerous multifaceted books and articles covering topics ranging from textbooks on psychiatry, poetry, socio-political analysis, as well as fictional works strongly reflecting his scientific and clinical experience and attempts to incorporate his patients' personal narratives. As a psychiatrist he favoured *ergotherapy* and communitarian psychiatry highly inspired by his visits to foreign psychiatric hospitals, such as Hanwell Mental Hospital in England or Geel Colony in Belgium.

Cebola published several books focusing on socio-political analysis where he promoted his praise of republican and democratic ideals. From 1945 to 1953, after the subsequent fall of the Portuguese republic (overthrown by military intervention in 1926) and the establishment of Antonio Salazar's authoritarian dictatorship (1928-1974), Cebola continued to publish his political writings imbued with, and conceptually embedded within, his highly refined medical discourse, where he also criticised state censorship and the banning of political opposition.

Our contribution to this session aims to explore Cebola's disciplinary border-crossings: republican beliefs, clinical experience, fictional narrative, and patient discourse together form a multifaceted work which can be seen to serve both a scientific objective (promoting psychiatry's coming-of-age in Portugal as a fully modern medical discipline) as well as comprise a complex metaphorical response in support of his political ideals and on-going criticism of dictatorship and censorship. Two representative works will complete our analysis: *Estado Novo e Republica* [Salazar's 'New State' and the Republic] (1955) and *Quando Desci ao Inferno: Contos Psicopatológicos* [When I Descended to Hell: Psycopathological Short Stories] (1955), the former being a collection of political essays criticising the dictatorship and the latter an anthology of short stories depicting the diverse mental pathologies, where Cebola displays portraits of mental illness that go beyond mere symptomatological enumeration offers.

Session Title: Mind, Science and Medicine

MEDICAL PHOTOGRAPHY IN THE 19TH CENTURY AT MEDICAL-SURGICAL SCHOOLS IN LISBON AND OPORTO

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Abstract

Science presents itself as a systemic and logical study of the world that surrounds us. The use of photography in the field of Medicine started back in 1840, when Alfred Donné photographed human blood and mucus, among others, using an instrument, which he named "*microscope-daguerréotype*". From the beginning, photography has been a useful instrument, perfectly adapted to the medical practices, allowing an accurate and permanent visual record of results and observations. Its use corresponds to three primary goals: investigation/ diagnosis, publication/ documentation and education/ teaching. It was particularly the latter that we have focused in this communication. We have studied inaugural theses and dissertations produced by the students who graduated in the Medical courses taught at the medical-surgical schools of Lisbon and Oporto, as well as the Faculties of Medicine of the same cities, in the period between 1839 and 1926, whose photographical record or its reproduction (photomicrographies, photographs or radiographies) resulted from research on several medical branches.

Throughout the nineteenth century, medical photographs will be often obtained with the collaboration of renowned photographers, leading to a high value corpus of photographic iconography related to the practice, diagnosis and communication in medicine. Initially, the photographs were executed in photographic studios, but at the end of the nineteenth century, photographic laboratories were installed in hospitals and other medical institutions, integrating photography into their daily routine.

In this communication we will also discuss the role of professional photographers in the evolution of photographic techniques and its relation to medical research and imaging in Portugal.

Session Title: Specialization in Medicine

PICCARDI EFFECT: A CURIOUS CASE OF WRONG COMMUNICATIONS OF SCIENCE

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Abstract

Giorgio Piccardi was an Italian chemist, director of Chemistry Department of Florence University. For dozens years he studied the "fluctuating phenomena "chemical reactions that, repeated similarly, produced different results. Particularly he studied some simple inorganic reactions claiming to have discovered an influence of interplanetary magnetic fields (overall of sunspot cycle) on them (Piccardi effect). The claim stirs up a debate between those who supported the reality of the discovery and those who believed in a self deception . Both side made big mistakes of scientific communication For example Piccardi effect has been linked to phenomena having no relation with it or contraddictory informations on this effect were written in popular books . In this paper , after a short introduction on Piccardi's results , mistakes will be described . In conclusion two author's contributions , for explaining Piccardi's results .and for using its method for didactical purposes ,will be mentioned

Session Title: Specialization in Medicine

MIGRATION OF MEDICAL ELITES AND SCIENCE CIRCULATION IN FRANCE: A STEP FOR CARDIOLOGY

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Abstract

This paper explores the mechanisms of transformations triggered by the Algerian war in France: in the university hospital setting, in the biomedical research and in the preventive and curative care for populations. In the middle of the twentieth century, on the French administrative territory, they were half a dozen medical faculties (giving a medical doctorate), including the faculty of Algiers (*Alger*), which were added medical schools. At the independence of Algeria (between Evian agreements and July 1962), in the process of migrating civilian French population (from several cultural backgrounds), it should be noted the massive departure of known actors of the national and international medical and scientific field. These men and a few women had titles, were at the head of the medical services or they were becoming. They thus became sociopolitical issues in Algeria as in France. Our subject concerns the French hexagon and how the conflict has transformed the medical community by providing deterritorialized actors which reconnected through exchange networks; they also brought new professional standards. Tours, middle town, with a medical school (not yet faculty) was concerned. We base our remarks on these multi-scale context and the particular example of a specialty, the cardiology which was supported by two university hospital personalities (they founded “L’école d’Alger”), a man and a woman. The latter will bring new postures clinical and therapeutic technologies in cardiovascular prevention and rehabilitation and in the place provided for the patients, associations as learned societies. This allows us to see patterns of horizontal as vertical communication with contrasting forms of recognition.

Session Title: Specialization in Medicine

AN EVOLUTIONARY PERSPECTIVE ABOUT THE LYMPHOCYTE IDENTIFICATION DURING THE FIRST HALF OF THE XXth CENTURY

Rinaldi Catalá T[a], Márquez Perez FL[a], Basco R[b], Colino P[a], Vaz Leal F[c]

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Abstract

INTRODUCTION: New technical advances based on the morphological descriptions realized by Pappenheimer allowed a better characterization of lymphocytes.

OBJETIVES: Report the most important publications about lymphocyte identification during the first half of XXth Century.

METHODS: Searching the term “lymphocyte*” on Pudmed and Scopus, delimiting the historical time.

RESULTS: Lymphocyte identification was made on base to morphological and functional aspects. Pappenheimer (1901) defined the lymphocytes as a particular group of leucocytes that show a determined morphological structure. Ward (1904) recognized two major types: small and big. Harvey, Ross, Norris, Nakahara, Murphy, Taylor and Earle studied lymphocyte behavior against different chemicals and physical agents (X Rays, light and heat). Abramson analyzed electrophoresis migration. Wiseman (1931) determined the maturity criteria for peripheral blood. Miller distinguished between lymphocytes and plasma cells using staining techniques, and Oelkers reported on the proteolytic enzymes. Eric and Harris (1946) and Habel, Endikorr, Bell and Spear (1948) demonstrated that lymphocytes were the antibody producer cells, different than macrophages. However, Fragaeus (1948) thought that this function was executed by plasma cells. In the morphological cytology field, Sundberg reported the morphology and functional dualism (lymphoid and myeloid) in the hematopoiesis. Erich, Drabkin and Forman (1949), evidenced the relationship between antibodies and nucleic acids, supporting Fragaeus’ results.

CONCLUSION: In the first half of XXth Century, lymphocytes were still quite unknown cells that aroused a great interest. At that time, lymphocytes and plasma cells were clearly differenced. Their responses against different stimuli delighted a functional profile that made it different to other blood cells, being recognized as the antibody producer cell.

Session Title: Specialization in Medicine

ORTHODONTIC APPLIANCES THROUGH HISTORY, WHAT DO WE USE NOW?

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Abstract

Orthodontics is a speciality of dentistry which studies the development of the occlusion and how to correct it using different appliances, removable or fixed ones.

For thousands of years, society has been concerned about aesthetics, everybody wants to have a beautiful smile and aligned teeth. Celsio in the first century advised to extract primary teeth in order to help the eruption of the permanent teeth. These teeth had to be pushed with fingers into the correct position. In 1836 Kniesel was the first to describe a removable plate to move teeth. He did so through different impressions which he obtained from impression trays to duplicate the anatomical shape of the dental arches. From that moment, Orthodontic appliances have changed and nowadays some of those appliances are no longer acceptable, this is because today Orthodontics has a greater aesthetic demand than it had in the XX century. Focusing on removable appliances, we try to make sure these do not affect the anterior area and sometimes this is not possible. We also want to make them as inconspicuous as possible, covering palatal-lingual and postero-vestibular in some cases in order to be less visible. Concerning fixed appliances (multibrackets), design has mainly changed two things, the first is that bracket size is smaller now and the second is the absence of “corners” and ties around brackets which led to Self-Ligating Orthodontic philosophy. Currently, the most used, or newest way of treatment is self-ligating brackets and the use of micro-implants for enhanced anchorage when complex movements are needed, joined to invisible bracket or invisible Orthodontic for mild or "not severe" treatments.

Session Title: Specialization in Medicine

HISTORY OF THE DISCOVERY OF EARLY EVENTS IN TUMOR FORMATION: THE FIRST STEPS OF ONCOGENETICS

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Abstract

In awarding Dr Barbacid its 1988 Prize, the Institute of Physiology, University of Berne, has began a controversial discussion in the history of science on the origin of oncogenetics. That started after being conferred the 1989 Nobel Prize for Medicine or Physiology. The Nobel winners would have benefited of a hastily decision by the committee that grants this Prize. This year the award was given to a North American team that worked in the same area than Mariano Barbacid. The documentary method always present with cancer research (as in the case of Li-Fraumeni syndrome), is good to recognize new ideas and its degree of elaboration from a historical perspective. We provide a periodization (1981-1985) of the discovery of mutations that involve a single base change, called a point mutation. The scientific fact for tumor onset. And we supply the phases of the elementary discoveries encapsulated in the history of this scientific program by using a historiographical typology own to the citation analysis. We understand the natural history of the case, by developing the population pyramid drawn up by the Spanish scientists who participated in this research.

Session 56 (i): Popularizing the Life Sciences

COMMUNICATING SCIENCE UNDER PERFORMANCE RESTRICTIONS: PUBLIC ACCESS DEFIBRILLATOR IN LAYMAN HANDS

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Public health considerations and medical evidence concerning resuscitation practice in case of heart fibrillation motivated initiatives of installing Automatic External Defibrillators (AEDs) as public-access emergency medical devices (PAD) in places with high public frequency such as train stations, airports, sport arenas, shop malls etc. Originally a high-tech medical device in the hands of experts the defibrillator had to be reshaped for layman use in the public sphere. The goal of the study is to reconstruct the history of the development of the public-access device in relation to the evaluation criteria with a special focus onto the communication choices. Central aspects in shaping the device for out-of-hospital use in layman hands were the *formulation* of instructions for the layman user (e.g. choice of language, oral instructions vs. pictograms), as well as the *amount* of diagnostic information to be communicated (e.g. whether electro-cardiogram should be provided in the display of the device). These goals depict considerations concerning the communication of science-based information to laymen in situations characterised by high performance expectations.
It can be shown that a great deal of the initial controversy was associated with the notorious neglecting of the distinction between *efficacy* assessment (with respect of the device performance under controlled conditions) and *effectiveness* assessment (with respect of the performance under every-day-life conditions). In order to overcome the laymen deficit in handling the medical instrument the technology design favoured a communication form based on evoking expert knowledge by standardised oral recommendations to the user through the device itself. The unknown user was replaced by the dictated layman dummy constructed by the expert discourse. The further choices concerning the framing of the installation vary according to the negotiations among the interest groups involved in the decision procedure. In most cases the compromise consists in concepts that presuppose a limited group of potential users with a minimum of experience or special defibrillation training.

Session 56 (i): Popularizing the Life Sciences

COMMUNICATING KNOWLEDGE: BENGALI PRINT MEDIA AND POPULARIZING MEDICINE IN NINETEENTH CENTURY BENGAL

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The development of vernacular print media in the nineteenth century Bengal helped in the spread of knowledge and awareness of Western Medicine in the domain of popular reading. The periodicals focussed on wide range of topics on medicine relating its role in society and in the development of the nation and its health. The journals edited by Bengali doctors helped to create a space for Western Medicine in indigenous society as an alternative to the practice of Ayurveda as the traditional medical culture. Some of them like *Cikitsa Sammilani* wrote on the three different systems of medical practice Ayurveda, Homeopathic and Allopathic medicine highlighting a new trend of plural practice in medicine developing in nineteenth century Bengal. Cikitsa Sammilani was edited by a *Kabiraj* or practitioner of traditional medicine and a Bengali doctor. It received the patronage of an educated *zamindar (* land lord) of Bengal . Through its varied articles Sammilani created a space for dialogic interaction among the practitioners of different systems of medical knowledge and played a key role in the dissemination of awareness about medicine. This vernacularizing thrust of the medical journals also revealed an attempt to create a new readership in medical journals among the vernacular literati in the districts and rural areas of Bengal . The aim of this paper will be to focus on the vernacular medical journals of 19th century Bengal especially Cikitsa Sammilani and to understand their role in creating and communicating new ideas of scientific modern national medicine.

Session 56 (i): Popularizing the Life Sciences

COMMUNICATING EVOLUTION TO A WIDER AUDIENCE: EVOLUTIONARY TOPICS IN PORTUGUESE POPULAR SCIENCE COLLECTIONS (20TH CENTURY)

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The presentation aims at providing a comprehensive view of a subject that has remained unstudied up to the present moment: the communication of evolutionary topics to wider audiences through Portuguese popular science collections during the first half of the 20th century. A considerable number of popular science collections was published in Portugal throughout the first half of the last century. Due to the extension of the presentation, we will be limiting our analysis to four of the popular science collections that granted more attention to evolutionary topics: Biblioteca Racionalista; Biblioteca de Educação Moderna; Cadernos Inquérito; and Biblioteca Cosmos. Where any translations of landmark evolutionary books published? What evolutionary theories and concepts were granted greater prominence? Where any biographies of key evolutionary theorizers included? Were there any original Portuguese works published and who were the authors? What was the overall significance of the volumes including evolutionary topics within each individual popular science collection? What balance can be made of the dissimination of evolutionary topics in the context of the communication of science to wider audiences? These are some of the main questions we will be seeking to provide with answers throughout our presentation.

Session 56 (i): Popularizing the Life Sciences

BIRDS OF THE FATHERLAND: CONSTRUCTING NATIONAL NATURE THROUGH ILLUSTRATED BOOKS IN THE LATE DUTCH REPUBLIC

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Late eighteenth century Europe saw a gradual transformation in the valorisation of natural knowledge in society. After two centuries of focusing on exotic nature with the universal goal of studying all God's creatures, Europeans discovered their own nature again. Spurred by the shifting political and economic power balance and a growing national sentiment, (cameralist) thinkers throughout the continent drew up plans to manage and examine domestic natural resources with the tools of science. In centralized kingdoms like Sweden and France, the new ideal of natural history as vehicle to improve society was communicated through state-sponsored platforms such as scientific academies, encyclopaedias and periodicals. But in the de-centralised Dutch Republic, natural history remained highly determined by a typical urban and artisanal knowledge culture: a collaborative network of upper-middle class amateurs of nature from the world of trade, religion and art.

This paper aims at explaining the role of a creative publisher of natural history books in putting national nature on the agenda of the late Dutch Republic. The Amsterdam bookseller-engraver Jan Christiaan Sepp (1739-1811) was a representative of an enlightened elite that was concerned about the relative economic and cultural decline of the Republic. In close collaboration with other experienced amateur naturalists, Sepp launched ambitious book projects that put Dutch nature on display for the first time, such as the *Nederlandsche insecten* [Dutch Insects] (1762-1925), *Nederlandsche vogelen* [Dutch Birds] (1770-1829), and *Flora Batava* (1800-1934). By closely examining the making of the pioneering *Nederlandsche vogelen* (issued in more than 200 instalments with hand-coloured and life-sized plates), I will show how the publisher and the author – the Remonstrant preacher Cornelis Nozeman - tried to redefine the standards of natural history into a useful and patriotic endeavour based on the literal and visual recording of their knowledge from the field.

Session Title: Popularizing the Life Sciences

HEALTH AND PRESS: A VACCINATION TO PREVENT POLIO AND THE CONTRIBUTION OF VARIOUS GENERALISTS PORTUGUESES NEWSPAPERS (1965/1966)

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Abstract

The discovery of the Salk vaccine (inactive virus, 1955) and the Sabin vaccine (attenuated virus, 1962) were decisive in preventing polio (disabling disease that preferentially affected children).

We conducted research on the number of deaths in Portugal caused by polio (through the analysis of the Demographic Yearbook, Journal of the National Statistics Institute - INE) and studied the prophylactic measures used in Portugal, which allowed us to evaluate the socioeconomic impact of the disease.

A vaccination campaign to prevent polio took place in continental Portugal between October 1965 and June 1966. This vaccination campaign was the basis of the National Vaccination Program started in Portugal.

The Portuguese periodical press was very important in the dissemination of the vaccination campaign against polio.

In this communication the authors present the results obtained in their investigation of (national and regional) Portuguese daily journals: *Diário de Notícias*, *Diário do Norte*, *Diário de Coimbra*, *Jornal de Arganil*, *O Setubalense*. The objective of the presentation is to evaluate how the vaccination campaign was addressed in the press: preparatory work, main figures, target audience, results achieved and difficulties encountered.

Session 56 (ii): Popularizing Mathematics, Physics and Chemistry

WHEN URANIA MEETS TERPSICHORE: THEATRICAL LECTURING ON ASTRONOMY IN NINETEENTH CENTURY BRITAIN

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Scientific spectacles, entertainments and lectures, had developed in many European countries since the Enlightenment. In Britain, there were itinerant lecturers such as James Ferguson and Benjamin Martin, who delivered discourses and demonstrated experiments on natural philosophy. Astronomy was an important subject in their repertoire. Lying at this root, a type of onstage astronomical lecturing raised and reached its heyday in the first half of the nineteenth century. During this period, various showmen exhibited the wonders of the universe in theatres and lecture-halls across British Isles, including the periphery like Guernsey. These onstage astronomical lectures were often accompanied by the transparent orrery – a large apparatus for scenic displays – invented and improved by the celebrated lecturer Adam Walker (c. 1730-1821) and his sons. The rivalry between astronomical lecturers was common, especially heated in London during Lent. The Walkers' *Eidouranion* and George Bartley's *Ouranologia* were two prominent instances in the 1820s, while C. H. Adams (1803-1871) and George Bachhoffner (1810-1879) gained popularity in London marketplace after 1830. Some popular lectures were highly influenced by natural theology narratives and often bore moral teachings or religious inspirations. These onstage lectures could also present novel scientific sensations, such as C. H. Adams's theme of French astronomer Urbain Le Verrier's "splendid discovery of an intra-Mercurial planet" in 1860. My study shows a broad spectrum of popular astronomy in nineteenth-century Britain, where the show business struggling to combine entertainment and instruction together with aesthetic and scientific appeal.

Session 56 (ii): Popularizing Mathematics, Physics and Chemistry

STRING THEORY IN POPULAR CULTURE – BETWEEN SCIENCE, FICTION AND ART

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The highly specialized field of string theory has become, in the last decade and a half, a major subject within the public communication of physics. The ambitious and all-encompassing perspective on the physical world proposed by string theorists, driven by the endeavour to reconcile general relativity with quantum mechanics, has had meaningful manifestations in popular culture. This paper aims to analyze the mechanisms through which scientific and popular accounts of string theory were co-constructed in the many attempts of scientists, science communicators and popular culture producers, to gauge this new understanding of the physical reality. Strings are depicted and conceived at the boundary of science with fictional discourse and aesthetic values. From Brian Greene's inaugural book The Elegant Universe (1999), to Karole Armitage's modern dance Three Theories (2010), the concept of string, as well as other implications of string theory – such as the eleven dimensions or the parallel universes, to name just a few – were the main topics for popularizations in a variety of media, where they were constantly enriched with new tones. The depiction of strings quickly spread in popular culture through sequels, TV science documentaries and science festivals, and then even through references into other pure popular genres (sitcoms, cartoons). This ultimately led to the creation of a soundly articulated constellation of popular products around string theory, with coextensive meanings, produced by actors placed inside, at the boundary, or even outside the scientific community. The fictional and the aesthetic infusion applied to the scientific acception of string theory attests a highly integrated communication process, which highlights the continuum between the professional and the popular.

Session 56 (iii): PopularizingTechnology

TRUST, EXPERIENCE AND CIRCUSES: ACADEMIC PERSPECTIVES ON COMMUNICATING ENVIRONMENTAL AND HEALTH RESEARCH RELATING TO ELECTRIC VEHICLES

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In recent years, how academic knowledge is communicated to publics, regarding environmental and health issues, has gained increased attention in the face of issues such as climate change. The translation of research findings into uptake of alternative technologies by consumers is a particularly pertinent issue in relation to electric vehicles. Previous science communication research has concentrated on the influences that individual perspectives amongst the public has on the uptake of scientific knowledge. This study uses research relating to the environmental and health impacts of electric vehicles as a case study to explore how individual agency, formed by personal perspectives and experiences, of the academic researchers can influence the communication process. Semi-structured interviews were held with researchers involved in the mentioned research field, however, in a wide-range of academic disciplines, and provided in-depth responses recounting the processes of communication; process knowledge.

As an outcome this exploratory study advocates a more reflexive approach to communication, as well as the formation of independent body, distinct from academia and any other communication intermediary, to provide more effective communication of scientific knowledge.

Session Title: Popularizing Technology

LANGUAGE OF FRIENDS. FOREIGN LANGUAGE ABSTRACTS AND SCIENTIFIC JOURNALS IN CZECHOSLOVAKIA 1918-1968

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Abstract

There were strong efforts to publish the results of the natural sciences through foreign-language summary in Czechoslovakia in the period 1918-1938. At the same time special scientific journals published important studies of Czech scientists in world languages. In addition to dominating French language, whose position also reflected international political orientation of Czechoslovakia during this period, and English, German was also used in certain fields. After WWII, and especially when the Communist Party took full control of Czechoslovakia (1948), the situation changed dramatically. The dispute was reduced to one question, whether to use English or Russian. Russian language was of course preferred primarily for ideological reasons. Acceptance of Soviet experience has become one of the main results that changed functioning of science at the turn of the 1940s and 1950s. Actual knowledge of Soviet scientific system and its institutions was largely limited in Czechoslovakia. This problem should be solved by publishing a magazine focused on various fields of Soviet sciences. Position of Czech scientists depended on the reception of their work in the Soviet Union, so they logically required translation of their studies into Russian language. Scientific journals published by the newly established Czechoslovak Academy of Sciences should continue to be based exclusively on Russian. However, this tendency was surprisingly short-lived, mainly because of the end of unsustainable theory of Soviet superiority in all scientific disciplines, technical difficulties in printing Cyrillic, absolutely critical shortage of translators into Russian and the fact that even the first-rate scientists knew no Russian. But even in 1950s, Swedish scientific researchers offered the delegation of Czechoslovak Academy of Sciences to publish summaries in Russian in their journals.

Session 56 (iii): PopularizingTechnology

CIVILTÀ DELLE MACCHINE (1953-1979) – AN ITALIAN JOURNAL CONNECTS ART, SCIENCE, AND TECHNOLOGY

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Post-war Italy offers a rich opportunity for studying communication about science and technology in a large and heterogeneous network of agents and audiences. Scientific and technological improvements were seen as crucial factors for economic recovery, and the popularization of scientific topics was part of a cultural strategy in support of this vision. Dedicated broadcast programs, book series, and periodicals were launched. Among the latter, the journal *Civiltà delle Macchine* achieved an outstanding position through its unique blend of artwork reproductions and analysis combined with serious popularization of science and technology. It was the state-controlled, large industrial group IRI that funded the journal *Civiltà delle Macchine,* giving the editors full freedom but also the mission of writing about its industrial activities – a task that they accomplished especially in the 1950s. The link to public and private industries, to academic institutions, and to artists and writers; the multifaceted profile of the journal's editors; the publication of essays in various original languages documenting the most recent developments in philosophy, science, and technology; and last but not least, the journal's high typographical quality: all these elements made the journal highly valued by readers and contributors all around the world. The bimonthly magazine was founded in 1953 by the poet, engineer, and marketing manager Leonardo Sinisgalli, who was followed in 1958 by Francesco D'Arcais, a trained mathematician and journalist. D'Arcais continued to involve artists, technicians, and scholars in the editorial enterprise and developed *Civiltà delle Macchine* in a History of Science publication. Archival documents and oral witnesses reveal a comprehensive network of diverse actors ranging from Nobel prizewinners to anonymous family members, readers, and bureaucrats.

Session 56 (iii): PopularizingTechnology

THE ROLE OF THE ESTONIAN TECHNICAL SOCIETY JOURNAL IN DEVELOPING AND INTERPRETING TECHNOLOGICAL CULTURE

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One of the most important aims of the Estonian Technical Society, established in 1917, was to prepare employees for technical fields, as well as promote industrial development and the study of natural resources. To spread and popularise technical knowledge and skills, the decision was made to start issuing a technical journal. The long war had driven the industry to the verge of collapse. It was clear that the end of the war would signal aggressive competition in the economy, and if the state did not manage to impose itself, political independence would remain a mere buzzword. The first step towards this was the exact cataloguing of natural resources and sources of energy. The idea of uniting industry and science sounds extremely modern. The subject of oil shale is clearly dominant. Results of Estonian engineers' experiments in London to produce crude oil from oil shale by pyrolysis are provided. In addition to introducing the tasks of Estonian economy, the journal extensively discussed the subject of technical education. The rapid decline in vocational skills during the WW I became an issue of concern. The congress of industrialists considered the improvement of work skills the most urgent problem. Opening a local engineering school would not mean disregarding study possibilities in foreign countries. The universities of Edinburgh and Glasgow that taught the fields of engineering, chemistry and mining industry agreed to accept Estonian students. In order to develop and improve technical vocabulary, the technical society formed a linguistic committee; new terms reached the public through the society's journal. The results of the society's efforts in promoting technical vocabulary in the native language and building a foundation for technical literature started to bear fruit in the end of the 1920s when a number of original technical textbooks written by Estonian authors were published.

Session 56 (iv): Popularization and Its Actors

COMMUNICATING ASTRONOMY FROM BELOW: THE CASE OF JULES PIERROT-DESEILIGNY (END OF 19THCENTURY)

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CERHIO, Le Mans

In this communication, I intend to show how an amateur astronomer, Jules Pierrot-Deseiligny, made his proper training in a few years, by reading periodicals, books, or becoming a member of *Societé Astronomique de France* exchanging letters with Camille Flammarion and other members of the society. These different ways of learning and appropriate science allowed him to practice high level observations and draws of lunar sites and thus, few years later, to have his name recognised as a moon place-name by the International astronomic union. This case ought to enlighten the process of science popularization from the point of view of receivers and questions crossing ways of science professional boundary.

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Session 56 (iv): Popularization and Its Actors

BUILDING A NEW SCIENCE: THE ROLE OF THE AMATEURS IN THE AMERICANIST'S SCIENCE (1850'S-1900'S)

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Between the years 1850 and 1914, the Americanist's movement was structured to become a recognized science. The role of the amateurs was important in this construction. For a long time, they travelled through American continent, studied old civilizations, as Mayans, Aztecs or Incas, since on their premises, took part in the international Congresses of Americanists. These activities led on the one hand to many publications and, on the other hand, to the formation of the first networks of scientific sociability. Whereas the Americanism was under professionalization process in the 1890-1900's years by a process of ousting of the amateurs, the latter gradually started to be diverted of a movement become too elitist in its philosophy. This communication thus proposes a study centered on the publications of the Americanists amateurs, from the mid-XIXth century to the period of professionalization of the movement, through three axes: their scientific publications, their role in the construction of the scientific speech in the international Congresses and their action in the construction of a scientific americanist's sociability.

Session 56 (iv): Popularization and Its Actors

FROM TURIN TO PARIS: AMEDEO AVOGADRO AND FRENCH SCIENTIFIC PRESS IN THE 19th CENTURY

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In the first part of his scientific career Amedeo Avogadro, author in 1811 of the renowned hypothesis on gases volumes and only Italian scientist whose name is linked to a fundamental constant, received more attention from the European press than the Piedmontese one.
In fact, Avogadro sent his works to the major European scientific institutions, like the Académie des Sciences de Paris, and published his most important results in the major journals of the period, especially in French ones. There are, among these, the «Annales de Chimie», the «Journal de Physique» – where the hypothesis on the volumes of gases appeared the very first time – and the «Bulletin Universel des Sciences Mathématiques, Astronomiques, Physiques et Chimiques publié sous la direction de M. le Baron de Férussac», where Avogadro's works regularly appeared.
Through the research of archival documents and unpublished correspondence, I tried to reconstruct the events that allowed the Italian physicist to enter the European scientific debate, to inform about his studies the maximum exponents of the science of that period (such as André-Marie Ampère, Claude Louis Berthollet, Hans Christian Oersted, Michael Faraday, Jean-Baptiste Dumas and many others), and to experience the delicate relationship between scientific popularization and French academic environment in the XIX century.
This research is part of my PhD project, which is focused on the digitalization of the full archive of Avogadro's handwritten documents and will lead to the publication of the "Avogadro Digital Library", under the supervision of Prof. Marco Ciardi (University of Bologna, Italy).
The Avogadro Digital Library project is a collaboration between the Institute and Museum of the History of Science of Florence - now called Museo Galileo, the Turin Academy of Sciences and the Turin Public Library.

Session 56 (iv): Popularization and Its Actors

SCIENCE POPULARISATION IN XIXth-CENTURY ITALY: THE CASE OF ANTONIO STOPPANI

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The aim of the paper will be to highlight the importance of science popularisation on Antonio Stoppani's cultural commitment within the greater context of the recently unified Italian State. Stoppani (1824-1891) was a Lombardian priest and scientist of the XIX Century, a Century to which he provided an important scientific and cultural apport. To begin with, he is remembered as one of the most experienced Italian geologists and paleontologists. His fame, however, is mainly concerned with some pieces of work that highlight his accomplishments as science populariser. Finally, Stoppani was one of the most important exponents of 'conciliatorism', strongly dedicated to reopen the dialogue between reason and faith, liberalism and Catholicism, scientific progress and religious doctrine.

Stoppani was convinced that «science was a right for all as the rays of the sun and the water on the Earth» and that it ought to be taught and popularised at all social levels. Consequently, in his most successful works of science popularisation he expressed all the pivotal points of his philosophical thought and scientific practice, presenting science as a crucial instrument for the development of the Country and the progress of Humanity; as well as a privileged medium for knowing the world, God and the providential design that underlies the equilibrium of the natural system. In particular, I would like to focus my attention on *The Beautiful Country*, published in Milan in 1876. The book had a great success and provided a decisive contribution to the process of the Italian "Risorgimento". In fact, it spread the knowledge of the Italian peninsula - in its physical and geographical aspects - through the new Italian State, contributing to give to the political and cultural unification strong scientific and technical basis, unavoidable in the new context of modern society.

Session 57: Ideas, Concepts and Communication in 20th Century Physics (i)

CONCEPTUAL METAPHORS OF THE MECHANISTIC WORLDVIEW

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The cognitive abilities explained by cognitive science and cognitive semantics can inform us concerning the use of metaphors in science. The thesis is that abstract ideas rest on experiences of the concrete world. In this paper I will explain the use of conceptual metaphors in science, with examples from the mechanistic worldview of the 17th and 18th century. If we proceed from the way people think in general, their mental abilities, reason and cognition, we could get close to an understanding of how scientists during the scientific revolution shaped their ideas about the invisible geometry of matter. This is a cognitive history of ideas. What is called the 'cognitive turn' in the humanities has generated vigorous growth of research, for example, in cognitive poetics, neuroaesthetics, and cognitive anthropology. These approaches try to arrive at an understanding of creative processes. In the historical sciences there is also a growing interest in cognitive-historical analyses, particularly in archaeology and history of science. The aim of the cognitive history of science is to reconstruct scientific thinking on the basis of cognitive theories. The starting point for a cognitive history of ideas that I defend here is that philosophy, science, and mathematics do not really happen just in texts, in language, in laboratories, or in social contexts, but in brains and minds in interaction with the world around the subject, and are thus connected to the body, to perception, thoughts, and feelings. We humans are captured in our brains situated in the world, we are dependent on our thoughts and senses, our prior knowledge, our mental images, when we try to create a picture of the world. Science, in other words, is shaped by our distinctive way of reasoning, not least in metaphors.

Session 57: Ideas, Concepts and Communication in 20th Century Physics (i)

MYDORGE'S EXPERIMENTS IN OPTICS

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Claude Mydorge (1585-1647) is a remarkable figure closely linked into the intellectual circle around Mersenne and Descartes. Educated by the Jesuits at La Flèche, the school also attended by Mersenne and Descartes, he received a degree in law, but never practiced law. Coming from a wealthy and influential family he was assigned an administrative post which left him ample time to devote to his interests, being mathematics, optics and astronomical observations. Mydorge is reported to have spend close to 100.000 écus during the 1620's on the fabrication of lenses and burning mirrors (Baillet 1691, II, 326). During the years 1627-1628 he commissioned the grinding of oval, elliptic, parabolic and hyperbolic lenses for his own use and for experiments by Descartes (Baillet 1691, I, 150). In addition to this considerable financial investment, Mydorge devoted much of his time experimenting with these optical devices. However, his findings and insights are only sparsely recorded. A treatise he compiled on his experiments with refraction was reportedly lost when William Cavendish brought it to England. Mydorge's son found three little treatises on optics in his estate (*De la lumière*, *De l'ombre*, *De la sciotérique*) which were subsequently lost. The extant sources which inform us about his optical experiments are limited to 1) his correspondence with Mersenne and Descartes, 2) some references by Mersenne in his *Quaestiones celeberrimae in genesim* of 1623, and 3) notes on optical experiments in the book *Récréation mathématique* (*RM*), first published in 1624. Only the first source has been used in studies concerning Mydorge, such as by Burnett (2005) and Schuster (2013). While the two others have only been mentioned marginally, they contain important clues on the kind of experiments he was involved in. Our study focuses in detail on these neglected sources in order to reconstruct a picture of how hands-on experience with optical artifacts can lead to knowledge not readily available from the mathematical approach in geometrical optics.

This paper fits into a larger project aiming to determine the kind of knowledge that is embedded (often tacitly) in material artifacts and contrivances, known from practical mathematics, and in the practices dealing with these objects. The project investigates the strategies used for extracting this knowledge and its application in theories on physico-mathematics at the beginning of the seventeenth century. As with many of the propositions in the *RM*, the optical artifacts discussed (colored glass, cut glass, lenses, camera obscura, mirrors, ..) were known from the magical tradition in the 16th century (Cardano, Della Porta, ..). However, with the new physico-mathematics, their original use for enticing wonder and astonishment is transformed into an epistemological tool for extracting knowledge about causes and effects.

Session 57: Ideas, Concepts and Communication in 20th Century Physics (i)

MAGNETISM AS ANALOGICAL EXPLANANS AND EXPLANANDUM IN THE SEVENTEENTH CENTURY

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Magnets and magnetism were used in the 17th century to explain a broad range of phenomena by analogy, from the rotation of the earth around its own axis and planetary attraction to the fecundation of the ovum without apparent direct contact with sperm. Magnetism itself was elucidated by a great variety of analogies in turn, from sympathetic attraction to the ordering and self-moving force of the soul to material effluvia or vibrating strings. It was thus integrated in different ways in various animist and mechanist world-views: as an explanatory principle magnetic force fit both an view of the earth as an animated, ensouled being, and a mechanical interpretation of life processes. Sometimes one and the same magnetic analogy persisted in very different world views, such as when the comparison between magnetic force and fecundation first conceived by the aristotelian William Harvey was taken up by the mechanists Borelli and Malpighi. And while Gilbert used it to explain the daily terrestrial rotation in an animist fashion, it inspired Kepler to model the attractive force between the sun and the planets as an inanimate *vis* (Collingwood). This talk will consider how magnetism was transformed, over the course of the 17th century, from a manifestation of life force and sympathetic attraction or a multiplication of species, to specific vortices or vibrations in mechanist theories, and itself something that could be used to explain other phenomena in a mechanist manner. In other words, how the phenomenon of magnetism was constituted through the analogies it was made a part of, both as explanans and as explanandum.

Session 57: Ideas, Concepts and Communication in 20th Century Physics (i)

THE DUTCH RECEPTION OF THE CONSERVATION OF ENERGY

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Among the several unifying principles that emerged in nineteenth-century science two stand out for their far reaching implications: Darwin's theory of evolution and law of the conservation of energy. Whereas the comparative reception of Darwin's work has been widely studied, little attention has been given to the European spread of the new concept of energy and the corresponding law. In my talk I will discuss the introduction of energy conservation in the Netherlands during the third quarter of the nineteenth century. As the Dutch case makes clear the concept of energy itself was fraught with difficulties. Its gradual appropriation by Dutch academics involved an amalgam of different routes and strategies, including heated arguments, popular lectures, new text books and even the introduction of a distinct terminology. In this process both the concept and the law were gradually sharpened and cleared of ambiguities. One of the examples I will discuss is the divergence of opinion between the leading Dutch physicists J. Bosscha and J.D. van der Waals on the 'potential energy' of a fluid, due to the attractive forces between its particles. The Dutch case nicely illustrates how the circulation of knowledge is indeed inextricably bound up with the production of knowledge.

Session 57: Ideas, Concepts and Communication in 20th Century Physics (i)

THE *INTERPRETATIO* OF EUCLID'S OPTICAL WORKS IN THE EARLY RENAISSANCE

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Francisco de Melo (*c*. 1490-1536) was the most important Portuguese mathematician before Pedro Nunes. He studied and taught at the University of Paris, where he wrote commentaries on mathematical works of ancient authors. Some of them are still extant in manuscript form, including those on Euclid's *Optics* and *Catoptrics* and (Pseudo)-Archimedes' *On Weights*. Melo's achievement was quite unique: he reworked the proofs of all the propositions, added corollaries and lemmas, deleted or substituted controversial and obscure arguments, and constantly referred to Euclid's *Elements* and *Data*. In doing so, he clarified the mathematical contents of the original works and showed sophisticated skills applied to the improvement of ancient mathematical texts. His commentaries constitute one of the first attempts to interpret ancient mathematical texts during the Renaissance and tell us a great deal about the teaching of mathematics in the University of Paris. Marshall Clagett recognized the importance of the treatise related to hydrostatics, but Melo's commentaries on optical matters were not given the proper attention so far. Our talk will illustrate the main features of this part of his commentaries, by contrasting some of his own arguments with the Greek original text and Bartolomeo Zamberti's translation of Euclid's optical works (the main source used by Melo). This case-study is especially useful to understand the general context of the scientific revisionism made in the 16th and 17th centuries, and the role played by the *interpretatio* of texts of Antiquity and the Middle Ages during the Renaissance. It supports a more general thesis holding that the birth of modernity was, to a great extent, a process internal to classical tradition.

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Session Title: Ideas, Concepts and Communication in 20th Century Physics

THE CERN THEORETICAL STUDY GROUP IN COPENHAGEN AND THE INTERPRETATION OF QUANTUM MECHANICS, 1952-1957

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Abstract

The European Council for Nuclear Research (CERN) was created in 1954 in a joint effort of eleven European countries. In 1952, as part of the preparations for its establishment, three study groups were created. One of them was the Theoretical Study Group, which was located in Copenhagen, Denmark, and led by the Danish physicist Niels Bohr. The group had the purpose of providing theoretical support to CERN's experimental efforts, but also the purpose of gathering young theoretical physicists from different countries together. The project expressed Bohr's belief according to which "closer contact between nations would enable them to work together on the progress of civilization in all its aspects." The group lasted in Copenhagen for five years, until it moved to Switzerland in 1957.

The scientific discussions that happened in the group were mainly about nuclear and particle physics, but also concerned some themes that had no direct connection with CERN's experimental efforts. For instance, the *formal approaches to quantum field theory* and the *quantization of the gravitational field*. In this talk, I will analyze those scientific discussions, in particular in what concerns these two last themes.

In such discussions, Bohr's ideas about the interpretation of quantum mechanics were raised, defended, criticized, and modified. I want to understand how knowledge circulated in the group, and how the discussions were performed. My purpose, by the end, is to understand how different approaches to quantum theory — as local algebras of observables, fields as distributions, quantum field commutators defined from field measurements, etc — could emerge from within Bohr's own research group. We can see in those discussions a tension between an admiration of Bohr by the young physicists, and their wish of pushing the limits of quantum theory. I will suggest this tension left its marks on those new approaches to quantum theory.

Session 57: Ideas, Concepts and Communication in 20th Century Physics (ii)

THE CONCEPT OF THE PHOTON AT STAKE: THE HBT EFFECT AND GLAUBER'S QUANTUM THEORY OF LIGHT

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In the late 1950s the British scientists Robert Hanbury Brown and Richard Q. Twiss performed an experiment whose observations seemed to be against what we have called the standard concept of the photon. In their experimental set up, a low intensity beam of light was split by a semi-transparent mirror and then detected through two different detectors. Considering the standard concept of the photon proposed in 1905 by Albert Einstein – photons as small and localized particles – there would not be expected to observe significant correlations between photons. However, they observed the opposite which was the existence of a correlation between photons after being split by the mirror. Such astonishing experimental result provoked a heated debate in the physics community, reopening thus discussions over the concept of the photon. Inspired by the HBT results and after the invention of the laser, the American physicist Roy J. Glauber tried to understand the relationship between the HBT observations and the laser light. Doing so, he developed a sophisticated theoretical approach to explain why the laser is coherent and thus constructed a full quantum theory for the light. In the early 1960s Glauber's theoretical achievements shed a new light on the concept of the photon being interpreted as an excitation of a quantum state and not whatsoever as a small and indivisible particle. In this talk we will argue that both the HBT effect and Glauber's quantum theory of light have an important role in how physicists came to understand what a photon is, or putting in a safe way, what a photon is not, during the 1950s and 1960s.

Session 57: Ideas, Concepts and Communication in 20th Century Physics (ii)

DREAMS OF TRANSNATIONAL URANIUM ENRICHMENT: INTERNATIONAL AMBITIONS OF THE DUTCH ULTRACENTRIFUGE PROGRAM, 1955 - 1962

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Since the start in 1955 the Dutch gas centrifuge program for the enrichment of uranium oriented itself towards other programs, especially the German and British projects. Scientists hoped to bring their separate endeavors together in a transnational “club” for gas centrifuge research. As the different programs did not know how far the others had advanced, the exchange of knowledge was necessarily tentative and gradual. Firstly, information on centrifuge patents was to be exchanged, and secondly more specific technological information, in both cases on the basis of reciprocity. In the end, the aim was to arrive at a full cooperation, in which knowledge could flow freely between the different groups. The dream was to create a transnational network of centrifuge scientists.

The obvious platform for this cooperation was Euratom. However, the role of this recently signed European treaty was double-faced. On the one hand, Euratom could provide major financial and organizational support. On the other hand, the distribution of centrifuge knowledge to, specifically, France and Italy was unwanted. As the technology could also be used for the production of highly enriched uranium that could be used for the production of atomic bombs, the dissemination of technological knowledge became a political issue. Discussions were interrupted by the visit of an American delegation that requested both the German and Dutch governments to classify the gas centrifuge technology as secret. When the officials complied with this request, the dreams of transnational cooperation were scattered. It would take years before the international discussions on gas centrifuge cooperation reappeared.

Session Title: Ideas, Concepts and Communication In 20th Century Physics

COMMUNICATING CONCEPTUAL CHANGES TOWARDS THE END OF THE NINETEENTH CENTURY: MACH, HERTZ, POINCARÉ AND BOLTZMANN

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Abstract

Towards the end of the nineteenth century, conceptual changes took place in physics. Scientist-philosophers such as Mach, Hertz, Poincaré and Boltzmann understood the importance of communicating these changes to the public. Mach uses his history of mechanics to support the changes he introduced in mechanics. Hertz used his introduction to the *Principles of Mechanics* to present his changes in the foundations of physics. Poincaré presented his criticism of mechanics in a congress of philosophy. Boltzmann presented conceptual changes in physics in his popular lectures.

Mach's *History of Mechanics* presents his solution for force and mass, which was taken up from a short paper written in 1868. Here, he criticized the vicious circle in defining mass at that time: weight was defined by mass and mass by weight. He proposed, then, a solution for the problem.

In the introduction to his posthumous work, Hertz developed a philosophy of physics on which to base his mechanical theory. With this *modus procedendi* the author aims to overcome conceptual problems in the foundations of mechanics.

In the International Congress for Philosophy, 1900, Poincaré put forward the question of if the fundamental equation of dynamics, F=ma, is verifiable experimentally. The question itself involves, however, a problem, he said, for we do not even know what force and mass are.

In 1905, Boltzmann collected the talks he had given on fundamental concepts and methods in physics, in particular mechanics concepts. The *Populaere Schriften* clearly shows the significance of communicating conceptual changes to the public. Indeed, as it will be shown, popular lectures were important for the authors themselves.

Session 58: Women and Science in Focus (i)

CONTESTED NUMBERS: THE QUEST FOR OBJECTIVE VALIDITY IN A STATISTICAL REVIEW OF THE "KINSEY REPORT"

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The media response to A.C. Kinsey et al.'s *Sexual Behavior in the Human Male* (1948) was massive and controversial. Kinsey's funding institutions—the Rockefeller Foundation and the National Research Council's Committee for Research in Problems of Sex—were particularly concerned about methodological criticisms and requested the American Statistical Association to assess the validity of Kinsey's results.

During the years 1950–1952, World War II companions and mathematicians William C. Cochran, C. Frederick Mosteller and John W. Tukey served on this review committee. Drawing mostly on Tukey's papers and the review group's internal correspondence during the collaboration, this project traces the political and personal threads which made it impossible for the evaluators to live up to their initial claim that they would exclude all non-technical and non-expositional matters from their review.

Sexuality was a highly contested category during the McCarthy era. Diverse personal interests as well as concerns about political and public response further complicated communication between the review committee on the one hand, and Kinsey's research group as well as his funding institutions on the other hand. As a result, continuous negotiations of partiality and diplomacy became an important part of the statisticians' work. Upholding the view that sound data and proper methods could produce objective validity required a virtual enclosure of the review group: They developed statistical methods that they knew would never be used by Kinsey's team, and formulated a devastating secret evaluation of Kinsey's methods. The informal and sarcastic tone of their internal communication differed widely from the correspondence with Kinsey himself and his funding institutions on the one hand, and from the mild and appreciative published appraisal on the other hand. This incident sheds light on how scientists navigated their interests and (mis)communicated their true results in an early stage of the Cold War imbroglio.

Session 58: Women and Science in Focus (i)

WOMAN I WAS BORN TO BE: AN INTERSEXUAL JOURNEY IN NINETEENTH-CENTURY ITALY

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During the nineteenth century, in Italy as in the rest of Europe, the pages of scientific journals were filled with cases of “doubtful sex”: the growing professionalization of gynecology and the emergence of new political models contributed to an explosion of accounts on hermaphroditism, a “sexual question” to which, in that positivist climate, only science could provide a “neutral” and “objective” answer. Conversely, the “standards” for “removing the ambiguity” of masculinity and femininity (while the selfsame thus transcended karyological aspects above/below numerical and consequent distinct biotypes for aneuploidy) transformed memoirs into “biographical profiles”, where the conflict between “biological sex” and “psychological sex” has staged the clash between “nature” and “culture” from which the "hateful" opposing dualism characterizing western thought and action has derived. This was in contrast to Mantegazza who instead predicted the union of the anthropological sciences and whose synthesis is inherent in anthropopoiesis. This paper describes the now-forgotten case of Maria Rosa, using unpublished documentary materials beginning with the scientific correspondence of the physician Vincenzo Chiarugi. This extraordinary case was studied by the physicians of Florence’s Santa Maria Nuova Hospital who decided to donate to the local pathological museum the anatomical preparation of the subject’s genital area, together with a wax cast illustrating its external appearance, as an example of the third type of hypospadias. These anatomical preparations and documentary materials recount the story of this pathological case from the past and, within a logical progression, permit the reconstruction of the complex doctor-patient relationship from the perspective of Western ethnomedicine, scientific progress, and the development of healthcare and social welfare institutions, using an analytical mixture of the anthropological (from the present to the past) and the social (from the past to the present) in disclosing a “truth” that was sometimes unknown even to the subject.

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Session 58: Women and Science in Focus (i)

FROM WOMEN IN SCIENCE TO GENDER IN SCIENCE

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This paper will present a brief history of the "women and science" and "gender and science" research fields and how they redefined history and philosophy of science and finally the sciences themselves. Through a both chronological and thematic approach, three moments will be underlined as possible ways for getting oriented in a rich and complex field, without pretending to exhaustiveness.

First moment is about making women visible in science. Thanks to the biographical work to rediscover women scientists, unexplored aspects of the scientific activity have been stressed, as the role of technicians, of spouses, of people with unofficial or precarious positions, the importance of correspondence, etc. This research had redifined the boundaries of the scientific activity.

Second moment is about understanding gender in the making of science and assessing the impact of gender in the evaluation of scientific activities. After observing the invisibility of women in science, it was necessary to understand the reasons for such an invisibility and to study processes through which women scientists become invisible as the Matthew Matilda effect well described by Margaret Rossiter.

Third moment is introducing gender as a methodological tool for innovation in science. The "gendered innovations" project ("Gendered Innovations in Science, Health & Medicine, Engineering, and Environment," 2011) funded by the European Union proposes to scientists and engineers methodologies to introduce sex and gender as heuristic tools for innovative science.

The paper will conclude on the contribution of gender studies to the history of science in general.

Session 58: Women and Science in Focus (i)

FIGHTING STEREOTYPES ON WOMEN IN SCIENCE: WOMEN AND SCIENTIFIC KNOWLEDGE AT THE UNIVERSITY OF PADUA (17th-19thCENTURIES). AROUND AND OVER THE ELENA CORNARO PISCOPIA CASE. (PAPER ON AN EXHIBITION)

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This paper is about the role of the University of Padua - the second oldest university in the world and among the most prestigious academies as regard to the progress and spread of the scientific thought from XVI until XIX century- in favoring or disadvantaging women's education in science. The case of Elena Cornaro Piscopia , the first woman graduated in 1678, is famous and known all over the world, but the issue does not stop here: there was a very lively cultural debate at that time in the Republic of Venice and in Padua in particular, that if from one side seemed to mock women's access to scientific knowledge, from the other the result is that the theme was widely discussed. Many pamphlets testify the interest of the intellectuals on the debate on female scientific education and a quick visit to some local archives has brought into light the existence of interesting notes of lectures and correspondences of some of these "femmes savant" with important scientists. The research also discusses the informative aspect of this question : the research on archival sources has given impetus to the will to let the younger generation know the story of these women, in order to try to tell another story of women in science, taking into account that the case of Elena Cornaro can be considered as a negative example, that discouraged many women to undertake the same path. She was exploited by her family as well as by the University of Padua to raise their own prestige , with neither respect nor consideration for her passion and her desperate will to know. Discovering other stories of women who after her and before her approached science in a different way and put their knowledge at the disposal of the others, outside the academy, in the public space, is nowadays particularly interesting and important in order to break negative stereotypes that are still keeping women away from choosing scientific paths. For this reason an exhibition has been studied and prepared at the university of Padua on the history of science from the gender point of view and a full account of this event will be part of this work.

Session 58: Women and Science in Focus (ii)

BRITISH GUIANA THROUGH HER EYES: HANNAH IM THURN, THE UNKNOWN ARTIST AND THE NATURALIST'S WIFE

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Despite the restrictions based on race, social class and gender from the mid-nineteenth century onwards, an increasing number of women travelled abroad. The case of Hannah im Thurn (1854–1947) is a fine example of a woman who remained within the boundaries of acceptable feminine behaviour while participating in scientific work. She was neither independent nor travelling by herself; rather, she was accompanying her husband Everard im Thurn (1852-1932) to British Guiana (now Guyana) where he was Government Agent in the North-West District. Little is known about Hannah im Thurn herself (née Hannah Cassels Lorimer), apart from the fact she was an artist from Edinburgh who married Everard, a Museum Curator, Botanist, Explorer, Anthropologist, Photographer, and Administrator. Yet Hannah im Thurn played an important role in development of British scientific and wider culture; here I will the discuss Hannah's work, which remains neglected within studies of Everard im Thurn's collections and work. Firstly, I will discuss how Hannah was involved in Everard's work, using as example the orchid watercolours in Kew Garden´s collections, which were in fact produced by her but misattributed to him. Secondly, drawing upon her perceptions about British Guiana and her Guianese experiences, I will examine her contribution to the making of an 'imperial knowledge' about the colony from a Victorian, female point of view. The recovery of Hannah´s contribution not only enriches the understanding of Everard im Thurn's collections, but also brings a different perspective to these.

Session 58: Women and Science in Focus (ii)

LONELY HEROINES, OLD MAIDS, AND BABE SCIENTISTS: FEMALE SCIENCE ON SCREEN

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Needless to say, popular movies significantly influence the public understanding of science. What strikes the eye, though, is that female scientists suffer from a blatant underrepresentation in fiction film. Moreover, these movies also frequently resort to certain, often sexist, stereotypes. The focus has so far rested upon male characters such as the *mad/bad, noble, inhuman,* and *dangerous scientist* (Haynes, 1996). Only recently, authors have begun to address the depiction of female science on screen; Flicker (2003), Steinke (2005), and Colatrella (2011) sketch out various stereotypes ranging from the *lonely heroine*, *old maid*, *male woman* to the *daughter or assistant* and also *babe scientist*.

The current talk juxtaposes two film productions, an older and a younger one, in order to discuss existing clichés of females within the scientific sphere: Zemecki's CONTACT (1997) and Cuarón's GRAVITY (2013) serve as case studies. One focus shall rest upon the relevance of (symbolic) space in film. Some of the questions read as follows: Are female scientists confronted with a "strategic marginalization" (Weingart, 2003) in film? What borders and boundaries do they encounter when, for example, it comes to pushing through research projects? Where do women scientists work – isolated in private labs or integrated into public universities? How much space do female scientist characters take up on the movie screen? What are their territories and how do they affect their access to knowledge and power? Further, how are their bodily spaces staged – are they sexualized or desexualized and thus confirm established gender stereotypes? The aim of this paper is to show how the consideration of (symbolic) space contributes to an analysis of women scientists on screen. These questions and thoughts demonstrate the constant need for observation of fiction films as they play a significant role in the communication and thus public understanding of science.

Session 58: Women and Science in Focus (ii)

THE FIRST RUSSIAN WOMAN-ZOOLOGIST SOFIA PEREJASLAVTSEVA

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In tsarist Russia a way for women to higher education was very difficult. One of the few women who have overcome all the difficulties, was Sofia Perejaslavtseva.

Sofia was born 1849, into a family of an army General. In 1869 she graduated from gymnasium and wanted to continue the education at St. Petersburg medical-surgical Academy. However, access of women to the Academy was terminated. Pereyaslavtseva's family did not support her striving for higher education, so she refused to material assistance from the relatives and went to Kharkov, where was engaged in self-education. Earning a living by translating, she saved enough money to travel abroad and moved to Switzerland.

In 1872 Sofia Pereyaslavtseva entered at the University of Zurich, where in 1875 defended the thesis for the Doctor's degree. However, within three years upon returning home she could not find work in a state institution. Fortunately, the prohibition to take women on scientific work did not apply to non-state institutions. In 1878 S. Pereyaslavtseva received an invitation to take the post of Director of the Sevastopol biological station. In this position she was from 1881 to 1891, becoming the second woman in the world, which stood at the head of a scientific institution (the first was Ekaterina Vorontsova-Dashkova, who led the St. Petersburg Academy of Sciences in 1783-1796's). With the first days of stay on the Station Pereyaslavtseva began to study the flora and fauna of the Bay of Sevastopol. In 1889 at the VIII Congress of Russian naturalists and physicians the scientific and administrative activity of S. Pereyaslavtseva received a high appraisal.

Leaving the post of Director of the Biological station for a number of reasons, S. Pereyaslavtseva the last few years lived in need receiving a modest pension from the Academy of Sciences. She died 1903.

Session 59: Science, Technology and Politics (i)

«AGENT» OF THE RUSSIAN ACADEMY OF SCIENCE V.P. VASILIEV

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In 1715 in Beijing for Russians, who lived in China was organized Russian Orthodox mission. Orthodox Mission in Beijing existed from 1715 to 1955. It played a crucial role in the development of Russian - Chinese relations. It also became a center for scientific study of China and the first training school for Russian sinologists. In the first half of the XIX century China pursued a policy of self-isolation. The only way for Russian scientists to have reliable information about China was Russian Orthodox Mission in Beijing. The priests of the mission, simultaneously with the implementation of missionary activity, carried out linguistic, ethnographic, botanical and other studies in China. They translated books and historical documents and collected different collections. Composition of the Orthodox mission changed once in 10 years. The Orthodox Mission in 1839 was accompanied by students of Kazan University V.P. Vasiliev, I.A. Gashkevich and Dr. A.A. Tatarinov. Student V.P. Vasiliev had the unofficial title of "agent" of the Russian Academy of Sciences. He had to learn Tibetan and Mongolian languages and bought rare books for the Academy of Sciences. F.F. Brandt (director of the Zoological Museum) and K.M. Baer (zoologist) was made detailed instructions for V.P. Vasiliev. For V.P. Vasiliev had been allocated 2205 rubles from the Academy of Sciences, This money were converted to silver bullion because in China was only silver money. As a result of his work in China V.P. Vasiliev sent to the Academy different collections, books and maps. In 1866 V.P. Vasiliev was elected a corresponding member of the Academy of Sciences.

Session 59: Science, Technology and Politics (i)

SCIENCE AND DIPLOMACY ON THE HORIZON OF THE NATIONAL EDUCATION BOARD (1929/36)*

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Founded in 1929 by the military dictatorship, the National Education Board (known as Junta de Educação Nacional) intended to modernize Portuguese science and pedagogy. In this sense, a considerable part of its scarce resources was applied in granting scholarships abroad, leading afterwards to scholarships in Portugal, with the funding of national scientific institutions and services of cultural expansion. With this strategy it was intended to seek a scientific update of the Portuguese academic community, followed by the reduction of the scientific gap between Portugal and most scientifically advanced countries, like France, Germany and England, leading to the internationalization of science produced in Portugal. In this communication I intend to analyze the case of the international law specialist Fernando Correia Pereira da Silva. As a fellow at the Institute of International Studies and the Faculty of Law of Geneva, and the London School of Economics and Political Science, Pereira da Silva gets the recognition of the international scientific community, enabling him to not only to lecture at the University of Geneva as well as joining the League of Nations. The relationships between science and diplomacy which are evident in this example will center my analysis, allowing us to get into new research agendas. Related to the role that scientists play in other sectors of society, and with the pressures and relationships in which they engage with the public authorities, these new agendas, analyzed by the perspective of intellectual, scientific and diplomatic path of fellow Pereira da Silva, allow us to set new interpretations of the national reality in the early 30s of last century.

Session 59: Science, Technology and Politics (i)

MOVING OYSTERS. SCIENTIFIC KNOWLEDGE BETWEEN NATIONAL SOVEREIGNTY AND INTERNATIONAL TRADE (1867-1895)

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Natural banks of oysters occur in Lisbon, in the southern margins of the river Tagus' estuary. The Portuguese Oyster, or the *Crassostrea angulata*, probably developed in Lisbon after arriving inconspicuously attached onto cargo ships coming from the Pacific, in the 16th century. The Portuguese oyster, although never popular in Portuguese gastronomical traditions, became attractive for French oyster merchants especially around the 1860's, after a shortage of their oyster population. French cargo vessels came to Lisbon to get Portuguese oysters, directly from the local fishermen. Free from custom charges, they were then transported to France, grown in oyster parks and finally sold with great profit.

This situation changed dramatically, in 1867, due to the intervention of José Vicente Barbosa du Bocage (1823-1907), Director of the Zoological Section of the National Museum of Lisbon. The reputed naturalist unmasked the French "illegal" incursion into Portuguese natural resources in a document presented to the Government explaining the urgency of imposing market regulations, and suggesting the benefits of a scientific study, allowing for acclimatization and encouraging national oyster production and export trade. Bocage signed a contract with the government for the possession of these oyster banks, with the objective of cleaning the existing banks, creating artificial growing tanks, and designing a scientific station for zoological research on molluscs. While this latter objective failed, the Tagus oyster industry still proved to be a profitable business for other concessionaires.

In this paper I argue that Bocage's strategy, and specifically the contract he signed were an ingenious combination of scientific expertise, economic liabilities and financial decisions in order to secure the nation's sovereignty over its natural resources.

Session 59: Science, Technology and Politics (i)

SCIENCE, RELIGION AND IDENTITY IN FRANCOIST SPAIN, THE EARLY YEARS

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This paper focuses on the break Francoism brought to the traditional attitude of Spanish conservative, right-wing parties and institutions (including the powerful Spanish Roman Catholic church) towards science, an attitude dominated by a negative, benighted stance towards scientific knowledge and institutions. The new regime acknowledged that the conservative parties made a strategic mistake in the 1920s in attacking the Junta para Ampliacvión de Estudios, and avoided it by designing and then setting up the Consejo Superior de Investigaciones Científicas—in many and crucial ways an original institution. The paper describes how the CSIC of the 1940s and 1950s did cater to the specific needs of the Franco regime.

Session 59: Science, Technology and Politics (i)

ENGINEERING THE SOCIAL REVOLUTION: TECHNOCRATS IN THE SPANISH CIVIL WAR (1936-1939)

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The Spanish Civil War (1936-1939) is among the most internationally and widely studied periods in history due to its geopolitical and ideological significance. Engineers and technicians, however, have been usually overlooked in most historical narratives on the military and social struggle. When taken into account, historians have mainly underlined their role in the war front in relation to the technologies of killing. On rare occasions, their tasks in the rear have also been studied, like their role in the building and regulation of the anti-air raid shelter network, or in the transformation of civil industries into war industries.

Drawing on previous work on the social and political rise of the engineering profession in Catalonia during the II Spanish Republic (1931-1939), this paper presents the preliminary results of my ongoing research on the Catalan engineers and technicians during the Spanish Civil War, and argues that, far beyond the war effort, technical experts actively participated and shaped -and even tried to lead- the social revolution which started on July 1936, promoting a scientific organization of the economy and a centrally planned management of the national territory.

Session Title: Science, Technology and Politics

THE PROBLEM OF EXPERTISE IN MEDICAL DECISION MAKING: BETWEEN AUTHORITARIAN AND DEMOCRATIC VIEW

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Abstract

The paper will deal with the question of the locus of expertise required for a competent and responsible participation in medical decision making. Until recently two mutually conflicting views on this issue have dominated the debate: the first of them (which I will call "authoritarian") allocating the relevant expertise exclusively in the hands of practising medical scientists and thus exempting lay public from the discourse on medical decision making; and the second (which I will call "democratic") claiming that lay public possesses the necessary expertise as well and therefore should be allowed to participate in the discourse on medical decision making alongside medical experts. Using selected case studies on expert and lay involvement in various debates over medical issues I will provide arguments for indefensibility of both the authoritarian and the democratic view and outline a third approach to the problem in question drawing on the Studies of Expertise and Experience research programme in contemporary Science and Technology Studies. In particular, I will claim that lay public by default does not possess the relevant expertise and cannot participate in medical decision making competently and responsibly enough in the light of available medical knowledge (as will be demonstrated on the MMR vaccine controversy), but that contrary to the authoritarian view its members can acquire the necessary expertise through prolonged immersion in relevant medical discourse, i.e. without formal education in medicine and direct participation in medical practice (as will be demonstrated on Steve Epstein's study of 1980s AIDS activist movement). On these grounds I will argue for the view that allowing the members of the general public with appropriate expertise to actively partake in the discourse on medical decision making can be mutually beneficial and that acquisition of such expertise among laypeople should be encouraged and appreciated, although by no means trivialized.

Session 59: Science, Technology and Politics (ii)

EXTINCT IN THE WILD: SCIENCE, IDEOLOGY AND THE PLACE OF THE EUROPEAN BISON, 1919-1945

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In 1919 the last 'wild' Polish wisent (or European bison) was killed. In 1927 also the last Caucasian population went extinct. At that moment less than 50 individuals remained in captivity – spread over zoos and menageries in different European countries. In order to save the wisent, an International Society for the Preservation of the European Bison (ISPEB) was founded, which had to coordinate the scientific breeding of the species. In order to do so a studbook was launched (a first in the history of zoos), and an exchange of individuals was set up. In the Białowieża Forest in Poland plans were made to reintroduce the wisent in the wild.

The ISPEB communicated the preservation project very much as an international and science-based endeavor – as an undertaking 'free of all political considerations and influences'. In practice, however, intellectual life was highly politicized in interwar Europe and the (shifting) borders between countries shaped the functioning of the ISPEB from the very beginning. Also contemporaries quickly picked up on the ideological issues connected to the preservation of the wisent. My paper will explore these issues and their repercussions for the breeding and reintroduction of the species. They involve controversies about what constitutes a 'pure' breed, about what counts as the 'natural' and 'original' habitat of the species, and about which nation could claim to offer the most 'efficient' preservation measures. They, furthermore, involved American money, Nazi imagery, Dutch middlemen and Polish forests. And, of course, 50 or so wisents being transported around Europe.

Session 59: Science, Technology and Politics (ii)

PHILOSOPHICAL AND HISTORICAL PERSPECTIVE ON THE CONCEPT OF "RESPONSIBLE INNOVATION" AND ITS CURRENT USE

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Our aim is to examine the potential technological bias in the recent attachment of the concept of innovation by the European Commission (*Horizon 2020*, *Sciences with and for Society*) to the qualifier "responsible" as a way to respond to demands for more responsibility in research. Our question is to see if the concept of Responsible Innovation is capable of providing ways to overcome some of the current ethical concerns. To do that, we explore the presuppositions within the concept of innovation, its history and the shift of meaning it has taken during the industrial revolution -from a theological concept of very negative connotation to an economy concept, considered to be at the core of human, social and economical development (Girard, 1990) and the ways it could be extended beside economics and technology (Schlanger, 1983).

Since the 18th century, innovation has become one of the main focus of economics theories and growth, has been progressively linked to technology (Godin, 2008) and has acquired a very strong positive bias. However, notions like growth and the core presuppositions of mainstream economy are being increasingly criticised on social and ethical bases, hence the need to reshape the way innovation is done.

Adding the qualifier "responsible" to innovation does not seem to be sufficient to erase the embedded presuppositions about the inherent value of technological development and growth. However, the history of the word shows that the concept is sufficiently flexible to allow shift in meanings and value. This flexibility, added to the fact that many other concepts like the concept of "development" (Latouche, 2004) have equal or worst ideological prejudices, allows us to conclude that the concept of Responsible Innovation might be useful, but only with a clear understanding of its embedded presuppositions and limits, in order to undertake another shift of meaning for the concept of innovation.

Session 59: Science, Technology and Politics (ii)

‘THOSE KNIGHTS IN SHINING ARMOURS’. RETHORIC AND POLITICS IN PORTUGUESE GEOLOGY DURING THE ESTADO NOVO

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The establishment of a geological community in Portugal was a complex process depending on a diversity of factors. The main purpose of this presentation is to address one of those factors: the public intervention in support of geology and geologists carried out during the Portuguese dictatorship, the Estado Novo, by three men: Mendes Correia (1888—1960), Carrington da Costa (1891—1982) and Carlos Teixeira (1910—1982).

Mendes Correia acquired scientific reputation as an anthropologist, ethnologist, and pre-historian archaeologist. He had also some political notoriety: he served as a deputy in the Corporate Chamber, between 1936 and 1942, and in the National Assembly, between 1945 and 1957. There, Mendes Correia used his acknowledged oratory talents to support geology and the action of geologists in the Portuguese society.

The action of Carrington da Costa primarily takes place in an institutional setting since his professional and scientific life was largely fulfilled by the occupation of several positions in public scientific institutions.

Carlos Teixeira action proves to be clearly more radical than those of his companions since his public intervention on behalf of geology presents features of a 'crusade'. The Introductions of the *Bulletin of the Geological Society of Portugal* (*Boletim da Sociedade Geológica de Portugal*) were one of Teixeira’s preferred means to carry out his ‘crusade’.

The public intervention of the ‘knights in shinning armours’ of Portuguese geology will be analysed within the more general context of establishment of a geological community during the second half of the 20th century. Its role as a strategy to assert and consolidate the scientific and professional status of geologists will also be highlighted.

Session 59: Science, Technology and Politics (ii)

THE JOURNAL *BROTÉRIA* AND PORTUGUESE SCIENCE DURING THE EARLY YEARS OF THE "ESTADO NOVO" (1932-1957)

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Established in 1902 by three teachers of the Jesuit College of São Fiel (Castelo Branco, Portugal), the journal *Brotéria* (1902-2002) was one of the most relevant learned and scientific journals published in Portugal in the 20th century. In addition to its uncommon longevity (at least for a scientific journal in the Portuguese background), *Brotéria* published more than 400 popularization articles and more than 1300 research papers on zoology, botany, biochemistry and molecular genetics. Between 1902 and 1932, under the direction of Joaquim da Silva Tavares S.J. (1866-1931), *Brotéria*'s main focus was the identification and classification of novel botanical and zoological species. Following the death of its first editor, *Brotéria*'s scientific agenda shifted from a pure taxonomical drive to a broader perception of zoology and botany, which then included new scientific subjects such as physiology, plant breeding, biochemistry and genetics. Under the direction of Alphonse Luisier S.J. (1872-1957), *Brotéria* began to publish articles from Portuguese scientists who were conducting their research at emerging public laboratories and scientific institutes such as the National Agronomic Station (Lisbon), the Botanical Institute of the Faculty of Sciences (Lisbon) and the Botanical Institute Dr. Gonçalo Sampaio (Oporto). Sponsored by national funds since 1930, *Brotéria* was thus contributing to the diffusion of the scientific work of some of the most prominent Portuguese biologists and also to the development of genetics and plant breeding in Portugal. In this paper, I shall focus on *Brotéria'*s publications from 1932 to 1957 in order to shed some light into the "Estado Novo"'s scientific agenda and into the scientific exchange and institutional collaboration between the Society of Jesus, the national laboratories and the Portuguese government in this period.

Session 60: Science to Read and Watch (i)

THE EYE OF THE OCTOPUS AND THE SEA URCHIN'S PEDICELS JEAN PAINLEVÉ'S INVISIBLE WORLD OF DETAILS

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My paper will be about the interrelation between artistic representation and scientific communication in the work of the French biologist, marine researcher and film-maker Jean Painlevé (1902-89). Painlevé's scientific films concentrate on so far mostly overlooked physiognomic details of unconventional 'stars': seahorses, fan worms and other denizens of the underwater world. In contrast to e.g. picturing details in photography the movie camera reveals its movement, the act of getting close and thus aesthetically corresponds to the epistemic metaphor of encountering truth 'at the bottom' of things.

My questions are: How does Painlevé create theses details by the means of his camera? How does the presentation of details in motion pictures modify our perception and understanding of the formerly unknown or unseen?

One of Painlevè's favourite animals was the octopus which he filmed twice in *La Pieuvre* (1928) and *Les Amours de la Pieuvre* (1965).

The main theme in *La Pieuvre* is the octopus breathing underwater, which evokes the association of an organ recital, and its death. Here the mystery of living and dying is symbolized in the eye of the octopus.

Les Amours de la Pieuvre Painlevé shows the complicated mating procedure of two octopusses. In hundredfolds magnification one can watch the growth of thousands of baby octopusses which finally hatch.

In both films Painlevé presents the animals as hybrid creatures, as biological miracles and dreamlike artefacts. His work especially reflects on the epistemic value of details and their functionalization in order to convey the complex interrelations of underwater life processes. My thesis is that his scientific art reveals the ambivalent power of details which on the one hand transform the formerly invisible into objective facts and on the other hand keep the object in a state of uncertainty by multiplying it. As we zoom in on glittering seahorses, fighting shrimps and mating octopusses we discover a microcosmos which broadens, sometimes even surpasses the world we so far took for reality.

Session 60: Science to Read and Watch (i)

GENERAL PRINCIPLES AND NARRATIVE DEVICES: ALICE MUNRO AND SOPHIA KOVALESKY

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The Russian mathematician Sophia Kovalesky (1850-1891) who made valuable contributions to the theory of differential equations has been the object of a short story by the Nobel Prize author Alice Munro called “Too Much Happiness” (2009). In my paper I want to revisit Alice Munro’s story in order to look at the way the imagination works in a literary work and in mathematics. Indeed, Sophia has written that “mathematics…requires great fantasy”. Karl Weierstrass, Sophia’s mentor, also understood the affinities between mathematics and poetry: “Rigorous, meticulous, one [mathematician] must be, but so must the great poet”.

Rather than arguing that literature may be a means of divulging biographies of mathematicians and other scientists or play with scientific ideas, I want to show that the structure and stylistic devices of Alice Munro’s story create a meticulous picture of rigor and great poetry that allows for the figure and work of Sophia Kovalesky to emerge among the myriad variables of a hard and very human experience and to show that the search for elementary truths is capable to co-exists with the contingent, time-bound and finite nature of life of a nineteenth century woman mathematician.

Session 60: Science to Read and Watch (i)

COMMUNICATING WILDERNESS
ON STIG WESSLÉN'S DOCUMENTATION AND REPRESENTATION OF THE NORTHERN SWEDISH LANDSCAPE

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This paper explores the communication of popular images of the Northern Swedish landscape, produced and mediated by Stig Wesslén (1902–1987) in the 1930s and 40s. Trained as a forester, Wesslén gradually turned into a documentarist, focusing on the wilderness, notably big birds, predators and the mountain range in Lapland. Along with making a number of ambitious movies and embarking on intensive lecture tours, he was an active debater and writer and published six, richly illustrated books. These careers were interwoven, partly for practical reasons; income from lecturing and journalism financed his filmmaking and gave him time to write his books. It is argued in the paper that Wesslén was driven by a strong feeling for wilderness and that he was against the way modern civilization exploited nature. The goal of his documentary work was ultimately to raise public awareness regarding the state of nature and he may thus be interpreted as a link between the preservationists of the early 20th century and the environmentalists of the 1960s. In order to unveil the 'true essence' of nature, Wesslén developed a scientific documentary technique, which he named 'camera hunting'. The idea was to use the best camera equipment possible and to observe nature at a remote, not to disturb the natural order of things, and to present authentic images. Yet, although Wesslén's works became very popular among the public, not least in Germany, professional scientists never accepted Wesslén as a trustworthy documentarist of nature. One reason for this was that Wesslén sometimes anthropomorphized the animals and also dramatized nature in many of his works. Another reason was that Wesslén was not a professional scientist himself.

Session 60: Science to Read and Watch (i)

«WHERE PUBLISHING MATHEMATICS IN FRANCE BEFORE GERGONNE'S JOURNAL (1810-1832)? »

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Les *Annales de mathématiques pures et appliquées* founded by Gergonne and known as Gergonne's Journal are the first French mathematical Journal. But before this publication, it was possible to publish mathematics in other periodicals as academicals journals, *Annales des sciences et des arts* (1809) or *Magasin encyclopédique ou journal des sciences, des lettres et des arts* (1792-1816). It is a question about Specialization vs Encyclopaedism as wrote Patrice Bret and Jean-Luc Chappey in an article on circulation of science published in 2012 in *La Révolution française*. Our talk will be a way for studying mathematics through Encyclopaedism thanks to these periodicals and contributions of some actors such as Aubin Louis Millin de Grandmaison (1759-1818) or A. Dubois-Maisonneuve.

Session Title: Science to Read and Watch

ERYTHROCYTES, AGING, VISUAL REPRESENTATIONS AND THE NEWS

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Abstract

The present paper addresses the dynamics of research conducted in the mid-twentieth century around the problem of erythrocyte aging and aims at exploring the field in its multiple contexts. The normal lifespan of the human erythrocyte as well as the selective removal of old cells from the bloodstream became well-established knowledge in the mid-twentieth century by resorting to isotopic labelling. Finding ways to distinguish between young and old cells has been then an important trend of research. The idea that the erythrocyte could be a privileged experimental model to the understanding of aging was the basis of much research work performed until the late 1980s and, in a way, implementing this idea has been a collective attempt. A comprehensive characterization of the field requires taking into account both the esoteric and the exoteric circles, to use Fleck's terms, and their mutual influence. My analysis also extends to the media and considers a news story reporting that a team of scientists had been able to develop means of visually distinguish between young and old erythrocytes (The New York Times, 1961). This text mentions the electron micrographs obtained and the prospective significance of the results in view of the understanding of the process aging in general. Starting from the fact that visual representations brought this research field to the non-specialized arena, I will discuss the relevance of imaging practices in the dynamics of research related to the problem of erythrocyte aging

Session 60: Science to Read and Watch (ii)

COMIC STRATEGIES AND THE COMMUNICATION OF SCIENCE IN CONTEMPORARY BRITISH NOVELS

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This presentation will discuss humour as a literary means by which contemporary British science novels communicate scientific knowledge. Science novels are understood as narrative fiction in which science plays a central role, and which seeks to portray the general circumstances, the moral ambivalences, and the economic complexities of scientific work. By correlating the science motif with the literary mode that is humour, the talk addresses a topical development in the fictional depiction of science: for most of the twentieth century, humour often portrayed science as somewhat obscure, and scientists as mere caricatures. In recent decades, however, the emerging category of science novels has begun to deploy comic strategies in much more diverse ways, for example in order to popularize scientific knowledge and to portray scientists as accessible and likable characters. Furthermore, humour is used to emphasize the cultural construction of aspects of scientific knowledge, for example when satire reveals the economic agendas of particular research projects.

The presentation will introduce several British science novels which employ comic strategies, such as the grotesque, satire, and pop cultural intertexts, in their literary communication of science. The focus will be on two contemporary novels: first, Hilary Mantel's *The Giant, O'Brien* (1998) is shown to feature grotesque elements in order to highlight the dangers of scientific obsession. Second, the pop cultural intertexts in Zadie Smith's *White Teeth* (2000) are discussed as representing science as harmless, familiar, and trustworthy, while the satire and irony of the novel reveal how scientific questions are impacted by cultural developments. I will argue that comic strategies are ideally suited to communicate scientific knowledge: literary humour itself depends on context, on familiar (stereo)types, intertexts, and pop cultural references, and therefore enables readers' to comprehend scientific information by relying on their cultural understanding rather than on scientific expertise.

Session 60: Science to Read and Watch (ii)

‘SCIENCE IN THE MAKING’: A 1931/32 BBC EXPERIMENT IN CITIZEN SCIENCE

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In the spring of 1931, the BBC broadcast a short series of talks entitled ‘Science in the Making’. Speakers in the series asked listeners to report their observations on such topics as the nature of their dreams, the weather, and the perception of sound. One talk, by John R. Baker on the timing of blackbirds’ egg-laying, resulted in the publication of an academic paper. The producer of the series, Mary Adams, considered this type of science broadcast to be highly successful as it introduced listeners to the methods of science.

A second series, the following year, had mixed fortunes. Listeners were asked to complete a multi-page questionnaire about their family circumstances and personal history, on the assurance that they were making a valuable contribution to social science. The questionnaire, however, proved controversial and popular newspapers condemned it as intrusive. The results were not made public, and no further broadcasts of this type were attempted.

The talk sets these broadcasts in the context of the newly emerging field of science broadcasting, and suggests that the failure of the second series was related to its flawed methodology, which resulted in very little useful scientific data. It also looks at Mary Adams’s outlook on science broadcasting, which she concluded had little scope for useful scientific dissemination, but could, if entertainingly presented, offer a stimulating diversion. The talk is based on original, unpublished archival research at the BBC, and contributes to the developing field of the history and sociology of science broadcasting.

Session 60: Science to Read and Watch (ii)

THE WISE VULTURE, OR DISCOURSES OF MODERNIZATION IN WILDLIFE TELEVISION DOCUMENTARIES IN 1970s SPAIN

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Félix Rodríguez de la Fuente (1928-1980) was an extremely successful and influential wildlife documentary filmmaker during the 1960s and 1970s in Spain. A film, radio and television producer and director, as well as a prolific author and editor, his work focused especially on ethology and conservationism. Through his complex multi-media effort, he managed to articulate a powerful representation of nature and the natural sciences.

Documentary cinema adopts multiple narrative and dramatic expressions to present images to the public as true reality. Thus, these films can be thought as useful tools to communicate certain ideas and concepts that are intended to be perceived as reliable and unquestionable. In this paper we analyze a documentary film from de la Fuente's renowned TV series *Man and the Earth*, titled *The wise vulture*, which was broadcasted through the Spanish Public Television (TVE) for the first time in 1978. In this piece, an Egyptian vulture served as guinea pig to look into the genetic roots of a specific behavior (i.e. breaking ostrich eggs with stones) in this species. Indeed, an experiment with such aim was painstakingly staged in the film. Our aim is to explore the narrative role of this experiment as a pretext to present a two-fold professional figure: the scientific naturalist and the (wildlife) filmmaker.

We argue that the nature-nurture question behind the experiment, together with the way it was depicted, were used to convey a specific notion of modernization that was, in turn, significantly rooted on professional (and however apparently accessible) scientific grounds. Such conception seemed indisputable as portrayed, while it was especially momentous in a broad socio-cultural sense, given the particular historical context in which the film was produced and broadcasted: the early years of the democratic administration after Franco's regime.

Session Title: Museums and Collections

THE COLLECTION OF NATURAL DRUGS OF THE FACULTY OF PHARMACY, UNIVERSITY OF COIMBRA

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Abstract

The Faculty of Pharmacy, University of Coimbra possesses a valorous museologic collection with significant interest to the history of science, pharmacy and pharmaceutical education.

The field of pharmacognosy and related sciences is one of the two most representative areas of this collection. The pharmacognosy is the science of drugs of natural origin, mainly of plant origin and derives etymologically from the Greek *pharmakon* (drug), and *gnosis* (knowledge). The pharmacognosy is intimately related to the teaching of pharmacy since its foundation at the University of Coimbra in the sixteenth century. The natural history of drugs, the name given in the early twentieth century, has become an essential area in the Faculty of Pharmacy that even possessed a small botanical garden. The Laboratory of Natural History of Drugs (founded in 1902) was later on known as Laboratory of Pharmacognosy. Throughout its history, the teaching and research of pharmacognosy has been of outmost importance. The collection of museologic interest precisely translates the interest given to the teaching and research of pharmacognosy in the Faculty of Pharmacy of Coimbra, since the nineteenth century until the present. In this work we include a sample of a vast collection that includes: more than 200 herbarium specimens; a collection of 250 reference drugs from E. Merck entitled *Drogen-Lehrsammlung*; 25 botanical models from the manufacturer R. Brendel (late nineteenth century); 264 different drugs in glass containers of various sizes and formats with plant parts (roots, stems, leaves, flowers, fruits and seeds) and products extracted from plants (essential oils, fatty oils, waxes, starch, gums, resins, tars, charcoal).

Disclosing this heritage, we are contributing to the study of both the history of pharmacognosy in Portugal and the Faculty of Pharmacy, University of Coimbra.

Session 61: Museums and Collections (i)

SAFEGUARDING THE PLASTIC´S HERITAGE

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This paper aims to analyze the technical-scientific, industrial, social history of plastics and its impact on society, since the 1910's.

Plastics, initially conceived as products to replace and imitate natural materials, acquired such a degree of development that there is practically no field of activity where they are not employed. In competition with traditional materials (metals, wood, ceramics, wool, etc.), plastics soon attained a prominent position due to their characteristics and the pace at which better materials, processes and new applications were developed. This development was not only the result of advancements in science and technology, but also a contribution to the progress of these areas. The need to solve problems through the development of plastics, as well as achieve materials with certain characteristics has led to research that led to advances in other areas of science and technology. As a consequence, the plastics industry has come to occupy a prominent place in the economies of industrialized countries since the inter-war period until the present day.

The paper will reflect on how this development should be put on display in museums with important collections of plastics objects. Starting with Bakelite, mass consumption of plastics products emerged, that later was taken over by thermoplastics such as polystyrene, polyvinyl chloride, polyethylene, ´acrylics`, and ´Teflon`. After World War II, many first-generation objects eventually disappeared, so it is therefore important to collect and preserve them, and put them on display.

Special attention will be devoted to some Portuguese collections of materials. Baquelite Liz, for instance, a Portuguese company that has worked in this area since 1940 in Leiria, the birthplace of the plastics manufacturing industry, has a wonderful collection that can serve as the basis for a future museum.

Session Title: Museums and Collections

SCIENTIFIC COLLECTIONS IN SOCIEDADE ARCHEOLOGICA LUSITANA AND COMISSÕES GEOLÓGICAS. CONSTRUCTION OF A SCIENTIFIC POWER?

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Abstract

Collecting activities were usually understood in Portugal as a recreational activity, and as a result of this, it was common to undervalue its fundamental role in various disciplines, inclusively in archaeology. However, in several narratives of scientific progress, collecting activities have been increasingly valued, reflecting a wider set of contexts, networks and relationships.

In this communication I intend to focus on the analysis of the organization process of collecting practices of two institutions: the Lusitanian Archaeological Society – created in 1850 was the first exclusively scientific archaeological society created in the country –, and also the Second Geological Survey, which formed the first collection of prehistoric archaeology in Portugal after 1857.

Usually interpreted by historiography as the founders of archaeology in Portugal landmarks, these institutions won recognition and scientific power through their collecting practices and exemplify how science and civil society intersected and influenced each other from the mid-nineteenth century. In this context, I will address: the circulation of knowledge, in particular new theories about the antiquity of the earth and of man and new methodologies, the process that originated collections and the context of collectors and institutions. In addition, I will compare the strategies used by each institution to validate their collection practices as relevant scientific achievements to society and for the «nation» construction process. By developing these topics I intend in this presentation to expose the international context of the beginnings of archaeology as a scientific discipline in Portugal.

Session 61: Museums and Collections (i)

IT'S ALL RELATIVE: STAFF-VISITOR RELATIONS SET AGAINST PHYSICAL SCIENCES IN CHINESE AND BRITISH SCIENCE MUSEUMS

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While there is continuous discourse concerning East-West knowledge transfer, one area that is only beginning to receive increasing attention within this context is science museums. Despite the association of communications channels in museums with the passing of scientific information from “the source” (scientists, etc.) to the "target" (visitors), the museum staff occupy roles of influence at various stages in the communication process. Authors such as Eilean Hooper-Greenhill, John Durant, and Sharon Macdonald write with focus on individual institutions, and many journal papers choose a visitor-studies approach to chart public engagement of science. Scholarship on border-crossing scientific public engagement is scarce, and little of this scholarship looks at the work of museum staff. The most prominent work on museum staff is Macdonald's *Behind the scenes at the Science Museum,* with few new works appearing in the past 10 years. This is why the object of this paper is to discover the roles of museum staff in the science communication process, and how this may vary between cases of science museums differentiated by nationality and funding status. This paper will draw on empirical research applying visitor-research methods used in the Science Museum in London in science museums in China. Such a “test” of communicability of visitor surveying aims to evaluate how public engagement – including interactivity with exhibits and feedback to the museum – of science differs between the East and the West. From these experiments, this research aims to analyse the grass-roots science communication in each case study, with the idea that the visitor-staff relationship is a vital component in the development of all science museums. The paper will conclude with notes on what museum staff perceive as the goal of the science museum in the minds of the visitors and vice versa, and the reasoning behind these impressions.

Session 61: Museums and Collections (ii)

CHANGING FACETS OF DIGITAL PRE-FACE OF SCIENCE MUSEUMS: THREE CASE STUDIES

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Museums are increasingly operating in a competitive environment where they have to constantly evolve new ways to engage the attention of people showered with a surplus of cultural information. Websites are effective for this purpose because in a given physical space the number of activities one can put together is limited as opposed to the virtual world. If museums reflect the intellectual and social order of their time (Bennett 2005), then, we argue, their websites must do so even more effectively, because that is the first point of recognition of the 'personality' of the museum for many visitors.

What we propose to do with this paper is to carry out a diachronic study of how science museums narrate their activities and histories through their websites. To do so we will analyse snapshots from the Internet Archive, the most important and widespread web archive. In doing so, we will obviously consider the historical reliability of re-born digital sources (Brügger 2012).

We have selected the digital platforms of three different kinds of science museums for our purpose, to have a comprehensive view of how they have developed their public image in the last two decades. These include the Deutsches Museum, Munich whose focus lies heavily on research; the California Academy of Science, which is most efficiently connected to social networks and the National Council of Science Museums, India, which establishes itself as the centralized body for education, communication and promotion of science.

Session 61: Museums and Collections (ii)

DATABASE OF SCIENTIFIC ILLUSTRATORS 1450-1950 (DSI)

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This online database at the University of Stuttgart portrays the illustrators of scientific publications of all genres (esp. atlases, articles, textbooks) active 1450–1950. Presently 6,500 entries in total, it will grow to 7,500 by the end of 2014. Currently particular emphasis is placed on anatomy and dermatology, astronomy, mineralogy, botany, zoology and general natural history; but other fields such as geology, chemistry and physics will also be included. Access to the database is free to all interested users at www.uni-stuttgart.de/hi/gnt/dsi/.

Why is this database being compiled? Existing biographical compendia mostly feature “true artists” catering to the fine arts market. Most scientific illustrators do not meet this ideal criterion and thus are not covered in existing reference works. There is thus a need for a convenient and easy-to-use historical finding aid for information about scientific illustrators. The aim of DSI is to provide this reliable information. Designed as an interactive website, it permits convenient searches in 20 search fields. It is possible not only to search for specific individuals, but also for illustrators working for a specific client or institution.

Modern media permit an entirely new, prosopographical approach to surveying their personal ties, patronage, the regions of their activity etc. This allows us to gain a deeper understanding of this important group of individuals and, in so doing, to develop a better grasp of scientific practice and its intricate private and professional social networks of collaboration. We will focus on the search options; and a few preliminary conclusions about these networks from our ongoing research will also be presented.

Session 62: Technology in Modern and Contemporary Times (i)

VIABILITY CRITERION AND THE AIRSHIP PROPOSED BY BARTOLOMEU GUSMÃO IN 1709

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The viability criterion was presented in the III Iberian American Congress of Philosophy of Science and Technology that took place in 2010 in Buenos Aires, Argentina.

Viability means the approval as viable by the peers of an accomplishment plan of something that has interest and doesn't exist yet.

Examples of accomplishment plans are technical specifications of products, production processes definition or the social coordination mechanisms definition.

With the viability criterion the distinction between communicating and making science, technology and medicine becomes blurred because making can be communicating for approval.

The purpose of this study is to apply the viability criterion to an example taken from history of science and technology in order to illustrate features of the criterion, like the role of prototypes in the evaluation of the viability and the relevance of adjusting expectations when describing the interest.

The selected example from the history of science and technology is the airship proposed by Bartolomeu Gusmão in 1709. We analyze the communication made about this airship and the acceptance that that communication had.

From the communication made, we have the petition presented by Bartolomeu Gusmão to king John V of Portugal asking the exclusivity of the use of the airship, the favorable reply given by the king to his petition, descriptions of the demonstrations to the court, and texts and pictures printed in European countries in 1709.

From the acceptance that this communication had, we have the content of the sonnets about the airship, the content of the pictures printed in Europe, and the position offered by the king to the inventor.

Thus, we can conclude that there were two accomplishment plans: the one of the printed picture, and the one of the demonstrations to the court. The printed picture was not considered viable. The demonstrations made to the court were not considered viable for the initial aim that was proposed.

The possibility of aerostatic ascent was demonstrated, without the practical applicability to the purposes expressed in the petition presented to the king.

Session 62: Technology in Modern and Contemporary Times (i)

THE CIRCULATION OF KNOWLEDGE: STEVIN'S *DISME* IN SERRÃO PIMENTEL'S *METHODO LUSITÂNICO* (1680)

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An early work on Portuguese fortifications, *Methodo Lusitanico,* was published in 1680 by the leading Portuguese cosmographer and engineer, Luis Serrão Pimentel (1613-1679). The *Methodo Lusitânico* meant an autonomous theorizing in the art of fortification in Portugal, due to the theoretical and military teaching sponsored by the Crown. The end of the Restoration War (1640-1668) mean that, by royal order, Luís Serrão Pimentel returned to Lisbon, giving classes at Ribeira das Naus; the number of students increased, passing his *Methodo* to make sense in another context than that of the dry border, i. e, to train engineers in Portugal who followed to India and Brazil.

The aim of our contribution is to analyse the European influences on Portuguese science in the seventeenth century through of the first written work in Portuguese and by a Portuguese on modern fortifications. Our analysis shows Serrão Pimentel to be a great mathematician and connoisseur of recently published works at that time, which he knows how to use in practice as well as justifying his choices, as in the case of Stevin's works. As far as contents are concerned, Serrão Pimentel analyses and reviews the published methods and changes as well as introducing new procedures to benefit the utility of mathematics.

Session 62: Technology in Modern and Contemporary Times (i)

ART AND SCIENCE IN THE ORGANS OF THE MONASTERY OF S. BENTO DE CÁSTRIS

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The music, universal language par excellence, reflects, in creation and interpretation different historical times. The musical instruments in turn also have their own history and evolution. In the case of pipe organs, they constitute one of the greatest musical spoils of Portugal, with part of them to abandonment or in degradation state in various regions of the country. Considered the most complex of musical instruments, with a large number of tubes driven by a complex mechanism of bellows and connections commanded by a desk of keys (registers) and keyboards (manuals and pedalboards), the organ has a multiplicity of timbres, being designated as the *king of Instruments*. In a brief historical narrative, the present approach focuses on the evolution of this instrument in Portugal in the context of the Iberian *organ building* distinguishing the scientific and technical components in the construction of this instrument in the seventeenth and eighteenth centuries and taking as example the organs of the Cistercian Monastery of St. Benedict of Castris, in Évora.

Flores de Musica pera o Instrumento de Tecla & Harpa, by Manuel Rodrigues Coelho, first printed in Lisbon in 1620 is a collection of sacred and profane music for organ, harpsichord, virginal, clavichord or harp produced in the Iberian Peninsula. Rodrigues Coelho prolonged the Portuguese and Iberian organ tradition, achieving a synthesis that helped relations between the Portuguese organ school and its foreign counters, in particular the Anglo-Dutch, Neapolitan and Venetian schools.

Session 62: Technology in Modern and Contemporary Times (i)

MANUEL FERNANDES DE VILA REAL'S *ARCHITETURA MILITAR Ó FORTIFICACIÓN MODERNA*

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During the first decades of the 17th century a scientific and technical cooperation between Portugal and Castile existed. For instance, several Portuguese geographers and cosmographers, such as Juan Bautista Labaña (1555-1624), Pedro Teixeira (1595-1662), or Antonio de Naxera "Lisbonensis" worked for he king of Spain. These collaborations went down during the Restoration War (1640-1668). In fortification particularly, both sides followed during the war Italian, French or Dutch authors without considering enemy's writings.

Surprisingly in the middle of the Restoration War, it was published in Spanish *Architetura Militar ó Fortificación moderna* (1649, Paris) written by the captain Manuel Fernandes Vila-Real (1608-1652), who was a Portuguese follower of João IV and a defender of Bragança's cause in France. The book is a modified translation of *Traité des fortifications ou architecture militaire* (1648, Paris) of the French Jesuit George Fournier (1595-1652). This treatise was not very influential in Spain; but during these decades few books on fortification were published in Spanish and it is quite extraordinary to find among the best ones a book written by a Portuguese.

An explanation of this unexpected publication can be found in Fernandes de Vila-Real's hazardous life. Of New-Christian origins, he lived in Portugal, Spain and France, and died executed by the Portuguese Inquisition in Lisbon in 1652.

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THE FAILURE OF *DESCRIPTIONS DES ARTS ET MÉTIERS* IN 18TH CENTURY FRANCE?

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The *Descriptions des arts et métiers,* published 1762-1788, was a monumental achievement of the *Académie des Sciences* in 18th century France. It was compiled by over thirty academicians and produced authoritative descriptions and representations of the arts and handicrafts at that time. But it was not published for over fifty years and seemed have no strong influence on Europe. Denis Diderot indirectly criticized René A. F. de Réaumur, director of the *Descriptions,* for keeping the work hidden and unpublished. And other scholars criticized the *Descriptions* for covering out-of-date technical knowledge at that time. These appeared to expose the inadequacy of the *Académie*'s project in communicating technical knowledge. The project of the *Descriptions* was an official enterprise that the *Académie* had to undertake to meet the state's needs related to technology. Its purpose was clearly to attempt to penetrate the secrecy of the arts, to promote progress in technologies and to give French trades the benefit eventually. But the project was likely to threaten French trading status by revealing technological details. Thus, it was rational to postpone the publication of the first volumes of the *Descriptions*. And its final publication in some sense was a response to the publication of Diderot and d'Alembert's *Encyclopédia* and to the changes in economic development in the era of industrialization. Furthermore, the *Descriptions* did contribute to the *Encyclopédia* when the latter used the former's contributors, organizer and editor, written texts and plates. Diderot was especially accused of copying the plates created for the *Descriptions* by Réaumur in 1755. The project of the *Descriptions* as an official enterprise represented the utilitarian dimension of the *Académie* in the Old Regime, and not a complete failure.

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ONE PICTURE, TWO SOLAR DESALINATION INDUSTRIES IN 19th CENTURY

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Since 1940 hitherto, one news had been spread about one solar desalination industry. Nevertheless, the image that was attributed to Las Salinas device (1872) it was a picture from a similar device built in 1907, in the same area of Atacama desert, but a hundred kilometres away in south direction.

Throughout our search in physical and virtual archives, public and private documentation from gremial organizations, researchers of solar energy, engineering mass media and general press, it has been possible to know many details about the plant of Las Salinas and we have discovered that there existed a second solar plant that was built some years later, in 1907.

The data allows to strength our conceptual approach of the intermittent duration of a sustainable technology that could be analysed in the framework of artifactual discard of George Basalla's perspective (1991). This could explain one of the ways of the evolution of technology in XIXth century and allow us understand some elements of communication in a globalized world. We wish to offer new insights on the early industrial use of solar energy.

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THE SPREAD OF INFORMATION TECHNOLOGY IN SPAIN IN THE 1980s: BETWEEN FEAR AND EUPHORIA

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Technological determinisms have become the common theoretical framework of most academic studies focusing on technological transitions in society. Generally, such studies focus on a few inventors whose devices are the central part in a linear narrative story. Furthermore, it has been argued that the simplicity of this model and its conformation with a huge majority of people's experiences enables technological determinisms to remain as the "common sense" explanation.

In this paper, we will explore the beginnings of the spread of IT in Spain during the 1980s, just after the country had left behind Franco's dictatorship. We will see in that period that the official media and policymakers tried to convey a deterministic vision of an IT revolution to the citizens, making it appear as something natural and unavoidable, and thus leaving no room for any social intervention or choice. In addition, this was a discourse of fear because it did not allow any chance of survival unless everyone took the unstoppable train of the computer society.

In this sense, we argue that such deterministic point of view was complementary to another slightly different discourse: the one that highlighted the stories of different schoolboys that got fame and richness by studying computer programming and designing videogames on their own. These stories conveyed the sense that a new successful entrepreneurial class was developing and only a deep personal dedication and a computer seemed to be needed in order to enter it.

In all, we will analyze the complex and dynamic relationship between these two discourses: on the one hand, the deterministic and allegedly digital modernization of the country. And on the other hand, the widespread idea that everyone –especially Spanish youngsters– could make their own successful future through the interaction with computers.

Session 62: Technology in Modern and Contemporary Times (ii)

COMMUNICATION OF COMPUTATIONAL RESULTS AROUND 1960 - A CASE STUDY

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There is no agreement about how old is *"Numerical Analysis"*. It is clear, however, that *"Computational Physics"* needed the advent of large programmable digital computers. While publications circa in the years 1945-1965 often discussed new possibilities to be opened by the use of computers, the years 1968-1975 brought various meetings where mathematicians and/or physicists met to look back, draw a balance and tell each other how much their fields of research had been changed through the impact of computers.

Around the same time, new concepts were developed to measure the quality of scientific articles in journals. By counting numbers of citations, the "*Institute for Scientific Information (ISI)"* identified the core journals of the science fields and the papers which were highly cited in a given time span in these core journals. During the years 1977-1993 these papers were called *"citation classics"* and given in several *"Citation Indices"* (SCI, SSCI and A&HCI) published by ISI. Today, an updated current version of the ISI data sets is available in the *"Web of Knowledge (WoK)"*.

The list of publications of *Oscar Buneman(n) (1913 - 1993)* in WoK is very sparse in the years 1938-1950. This is explained by his internment as *"friendly enemy alien"* and by his classified military research for Britain in the years 1941-1950. His (and probably THE) first publication in the newly developing discipline *Computational Plasma Physics* (1959) turned out to be a citation classic 25 years later. His manuscript on the *"Buneman Algorithm"* (1968), however, was rejected by four journals and led to a citation classic of three of his colleagues.

The talk will offer an explanation why these two manuscripts had so different fates.

Session 62: Technology in Modern and Contemporary Times (ii)

ROADS FOR DEVELOPMENT: PORTUGUESE HIGHWAY ENGINEERS AND THE APPROPRATION OF TRAFFIC ENGINEERING

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This paper aims to explore the concepts of circulation and appropriation of technology between centres and peripheries, from a new theme in Portuguese historiography, the highway engineering and its connection to discourses of "development" (*fomento*). At the European level it aims at identifying the itineraries of circulation of Portuguese highway engineers either through training courses in universities (through scholarships), and participation in international conferences and seminars (for instance, those promoted by the International Road Federation or by European technical cooperation organizations). At the national level, I will focus on the contribution of highway engineers in the use of a development's (*fomento*) rhetoric in the framework of the *Development Plans* (*Planos de Fomento*), as a strategy to enrich their projects with economic justification for building roads with improved technical characteristics. I want to study how this discourse, incorporating the concepts of traffic engineering, justified, for example, plans to build motorways in the metropolis in the 1950s; and its relation to the Portuguese adhesion to the "Main International Traffic Arteries".

Session 63: Chemistry in Place

COURTROOMS, UNIVERSITIES AND ACADEMIES: EXPLORING THE SITES OF SPANISH NINETEENTH-CENTURY TOXICOLOGY

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Pere Mata i Fontanet (1811-1877) was the most important Spanish toxicologist in the Nineteenth-century. However, he remained as an invisible character outside Spanish borders. He was the author of the most influential Spanish treatise on legal medicine and toxicology, which had six editions but was never translated. He even claimed that any other author abroad had been able to write a treatise as complete as his. His treatises did not include experimental results but rather a rhetorical discussion and a place where he could claim for changes to be made in those new sciences. His participation in famous trials, such as poisoning cases only contributed to increase his claimed authority as an expert. I argue that it was precisely, during those trials, when experts had to face the puzzling questions of lawyers and jurors, that toxicology was built.

Mata moved customarily from his teaching chair in the Faculty of Medicine to the meetings of the Academy of Medicine where he gave many lectures as well as to the courtrooms in which he was frequently requested as expert witness in murder trials. Following Mata's steps points out the need to cross many institutional and disciplinary boundaries and allows exploring a rich variety of scientific, medical and legal sites. I will analyse how the different sites of toxicology were connected. Thus, experts such as Pere Mata largely encouraged the hybridization of the different social spaces which All these popular and academic spaces included unspoken rules concerning who was allowed to participate in or who was granted with authoritative voice. Experts tried to transport the debates to the spaces in which they felt they had more chances to win the controversies, either courtrooms or public sphere or for instance in academic journals, classrooms and textbooks.

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Session 63: Chemistry in Place

SUBTLE OR MALICIOUS?
A CONCEPTUAL HISTORY OF DIBORANE AND BORON CHEMISTRY

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In my presentation, I will focus on the conceptual development of boron chemistry. Modern boron chemistry was founded in 1912 by Alfred Stock, out of his belief in an essential analogy between boron and carbon chemistries.

However, diborane (B_2H_6) soon revealed its uniqueness. In particular, Lewis' 1916 chemical bond theory could not be applied. A pressing quest for its structure and bonding nature was then initiated, leading boranes (B_xH_y) to cross geographical and disciplinary boundaries by imposing a concerted effort by many leading experts in the appropriate physical and chemical methods available at any given time. When, in the 1950's, William Newton Lipscomb published his three centers-two electrons concept to solve the problem, it was the outcome of an unusually complex and intertwined ontological drama involving, among others, carbon chemistry ontology, one-electron and hydrogen bonds.

The puzzling problem of diborane "insidious" structure and bonding nature was addressed by many of the key players in chemical bond theory, having proved immune to all the attempted accommodations by a multitude of much diversified models, languages, and different kinds of theoretical explanations, both in the pre-quantum and quantum eras.

Despite being practiced by two small research groups in German and in the USA and its absolute lack of any practical applications until the Manhattan Project, boron chemistry was understood as posing fundamental conceptual and theoretical problems, at one time being pointed as the ultimate test to any chemical bond theory.

Boron chemistry's conceptual development is an incredibly rich case-study and its history is a privileged stage where one can observe the intricate interplay and historical and theoretical adjustments between many of the central modern bonding concepts as well as the dramatic resilience, flexibility, adaptation, evolution, recycling and combinatorial capabilities that concepts can offer under much different empirical and theoretical contexts.

Session 63: Chemistry in Place

THE EMERGENCE OF A CHEMICAL APPARATUS IN THE LATE EIGHTEENTH CENTURY: THE PORTABLE PHOSPHORUS EUDIOMETER

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During the last quarter of the eighteenth century eudiometry was abandoning its commitment with meteorology for determining the goodness of atmospheric air and approached to chemistry and medicine as allied sciences. From 1772 onwards, when Joseph Priestley suggested his nitrous air test to replace mice and birds for checking the air salubrity, different kinds of eudiometers – the instruments or apparatuses designed to measure how healthy air was – began to proliferate.

Landriani's (1775), Fontana's (1775) and Magellan's (1777) eudiometers based on the nitrous air (nitric oxide) test had soon to live together with three other kind of eudiometers: Volta's eudiometer (1778) grounded on the combustion of inflammable air (hydrogen), Scheele's eudiometer (1779) based on the absorbent activity of a wet paste made with iron fillings and sulphur, and the phosphorus eudiometer founded on the diminution of volume experimented by an air sample because of the combustion of a piece of phosphorus. In the year 1778 the German chemist Franz-Karl Achard presented the first exemplar of a phosphorus eudiometer.

The making of the different versions of this phosphorus eudiometer is an episode of the history of chemistry that deserves to be explored for several reasons such as transnational involvement, theoretical grounding, experimental procedures and portability of the instrument. Prominent chemists from different countries (Humboldt, Berthollet, Guyton de Morveau, Lavoisier, Séguin, Giobert, Spallanzani) contributed significantly in the shaping of the diverse types of these apparatuses. The instrument and its corresponding experimental procedures evolved not only along with the conflict between the phlogiston and the oxygen systems but also mutated when the phenomenon of the slow combustion of phosphorus claimed the chemists attention. Finally, portability was a wanted and appreciated distinctive feature of the phosphorus eudiometer. This presentation pretends to tackle the above-mentioned aspects to give a comprehensive picture of the apparatus

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WORKING AS A CHEMIST ON THE OCCASION OF A VOLCANIC ERUPTION

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During my studies in the history of chemistry of the Kingdom of Naples in the 18th century, I found a number of chemical inquiries in papers published to describe the eruptions of Vesuvius. I was really amazed by the fact that a frightful event such as a powerful volcanic eruption had the immediate effect of giving a strong impetus to the debate among the chemists.

The aim of the paper is to give a sample of this variegated range of publications, by which we can take a lot of interesting information about the uses of chemistry in Naples, but we can also face the rich series of figures that employed chemical reflections in their “relationship” with the Volcano.

The core of my presentation is represented by how the explosions of Mount Vesuvius constitute a noteworthy episode in the public perception of science, because scientific ideas, I mean for example the Chemical Revolution, were debated and popularized by a gardener as well as by a professor of the Royal University. To do it I will present some different publications on the same eruption, by very different authors, and their main chemical references.

It would be a starting point to show how chemical information was accepted or understood by the public or government officials and how the Neapolitan volcanic area created a cultural background characterized by frequent references to these chemical inquiries.