CSHPM/SCHPM

The Canadian Society for History and Philosophy of Mathematics /
La Société Canadienne d'Histoire et de Philosophie des Mathématiques

2022 Annual Meeting/2022 Colloque Annuel

Program

Note: The conference is being held in Eastern Daylight Time.

Special Session: Friday, May 13

Session 1
10:00 AM Welcome by Craig Fraser (President of CSHPM/SCHPM)
10:15 AM Annual Kenneth O. May Lecture: **Emmylou Haffner**, École Normale Supérieure, Université Paris Sciences et Lettres, *Going to the source(s) of sources in mathematicians' drafts*

11:30 AM BREAK

Session 2
Session Chair: Amy Ackerberg-Hastings
12:00 PM Mario Bacelar Valente, Pablo de Olavide University, *Ancient Greek mathematical proofs and metareasoning*
12:30 PM Craig Fraser, University of Toronto, *Original Sources in Research Mathematics: The Case of Hamilton-Jacobi Theory circa 1900*
1:00 PM Julia Tomasson, Columbia University, *Reading Uqlidis in New York: The Making and Unmaking of "The Arabic Euclid" in Columbia University's Rare Book and Manuscript Library*

1:30 PM BREAK

Session 3
Session Chair: Andrew Perry
2:30 PM Emily Hamilton, University of Massachusetts, Amherst, *It's 6am. Do You Know Where Your Calculus Teacher Is?*
3:00 PM Valérie Lynn Therrien, McGill University, *The Evolution of Cantor's Proofs of the Non-Denumerability of* $\mathbb{R}$
3:30 PM Cynthia Huffman, Pittsburg State University, *Mathematical and Philosophical Imagery in Original Sources Related to Émilie du Châtelet*
4:00 PM Glen Van Brummelen, Trinity Western University, *Hidden in the Manuscripts: How Bianchini's Texts were Read and Used*

4:30 PM BREAK

Session 4
5:00-6:00 PM Informal Discussion Time/ Social Hour
Host: David Orenstein

General Session: Saturday, May 14

Session 5 History of/in Mathematics Education; Histoire de/dans l'enseignement des mathématiques

This panel looks, in part, at the History of Mathematics Education, both through one pedagogue's impact (Dunning), and at international efforts at mutual support (Orenstein). We also consider the use of History of Mathematics in delivering Mathematics courses, specifically looking at how arithmetic was carried out over time (Nuno Silva).
Session Chair: David Bellhouse

10:00 AM - 10:30 AM **Jorge Nuno Silva**, University of Lisbon, *Who was able to perform multiplication and division of large numbers by the year 1 CE? And by the year 1000 CE?*
10:30 AM - 11:00 AM **David Dunning** , Oxford Univ, *Constructing the 'Home-side' of a Scientific Legacy: Mary Everest Boole, Pedagogy, and Domesticity*
11:00 AM - 11:30 AM **David Orenstein**, Danforth CTI, Emeritus, *The 1992 Quebec City International Congress on Mathematical Education (ICME) / Le Congrès international sur l'enseignement des mathématiques (CIEM) de 1992 à Québec*
11:30 AM - 12:00 PM **Panel Discussion, Followed By General Discussion and Questions** (Jorge Nuno Silva, David Dunning, David Orenstein)

12:00 PM BREAK

Session 6
Session Chair: Maria Zack
12:30 PM **Jean-Charles Pelland,** University of Bergen, *Recipes for talking about mathematical progress*
1:00 PM **José Antonio Pérez Escobar**, École Normale Supérieure, Université Paris Sciences et Lettres, *Showing mathematical flies the way out of foundational bottles: the later Wittgenstein as a forerunner of Lakatos and the philosophy of mathematical practice*
1:30 PM **Nicolas Fillion**, Simon Fraser University, *Pedagogy and curriculum in intermediate logic courses*
2:00 PM **Patricia Marino**, University of Waterloo, *On the Use of Mathematics in Economics: Formalism, Fit, and Physics*

2:30 PM BREAK

Session 7
Session Chair: Nic Fillion
3:00 PM **G. Arthur Mihram and Danielle Mihram**, University of Southern California, *Limited Roles for Mathematics in Science and in Academic Curricula*
3:30 PM **Chanwoo Lee**, University of California, Davis, *Foundation as Scaffolding*
4:00 PM **Iman Ferestade**, Simon Fraser University, *Do engineers really know what they are doing?*

4:30 PM BREAK

Session 8
5:00-6:00 PM Informal Discussion Time/ Social Hour
Host: Rob Bradley

General Session: Sunday, May 15

Session 9
Session Chair: Craig Fraser
10:00 AM **Maria Zack**, Point Loma Nazarene University, *Blaise Pascal, Amos Dettonville, and the Roulette*
10:30 AM **Hassan Amini**, University of Tehran, *Codex Paris 772 as a source for History of Mathematics*
11:00 AM **Gregg De Young**, American University in Cairo, *Changing perspectives on the medieval transmission of Euclid's Elements*
11:30 AM BREAK

Session 10
Session Chair: David Orenstein
12:00 PM **Amy Ackerberg-Hastings**, *MAA Convergence*, *Comparing the Histories of Professional Societies for Women in STEM*
12:30 PM **David Bellhouse**, University of Western Ontario, *The Evolution of the Field of Statistics: A Case Study from Twentieth-century Manitoba*
1:00 PM **Dirk Schlimm and David Waszek**, McGill University and CNRS, Archives Henri Poincaré - Nancy, France, *John Venn's pluralism regarding logical forms*

1:30 PM BREAK

Session 11
Session Chair: Pat Allaire
2:00 PM **J.J. Tattersall and S.L. McMurran**, Providence College and California State University, San Bernardino, *Cambridge Women's Research Club*
2:30 PM **Ruigang (Paul) Xu**, McGill University, *Hugh MacColl and Counterpossibles*
3:00 PM **Christopher Baltus**, SUNY Oswego, *Was Jacob Steiner a cofounder of projective geometry?*

3:30 PM *BREAK*

Session 12
4:00- 6:00 PM Annual General Meeting (AGM)
Presiding: Craig Fraser

Abstracts

Amy Ackerberg-Hastings, *MAA Convergence* (aackerbe@verizon.net), **Comparing the Histories of Professional Societies for Women in STEM**

For the 50th anniversary of the Association for Women in Mathematics (AWM), I reviewed the histories of many of the other major national organizations established by American women in science, technology, engineering, and mathematics (STEM) throughout the 20th century. A number of parallels emerged in motivations, actions, and outcomes—not only among the three associations that were formed nearly simultaneously (Sociologists for Women in Society, AWM, and the Association for Women in Science), but also among a larger group of societies that includes Graduate Women in Science, the Society of Woman Geographers, the Society of Women Engineers, the Association for Women Geoscientists, and the Earth Science Women's Network. A collective organizational history helps us better understand the contexts in which women in STEM have pursued professional identities.

Hassan Amini, University of Tehran (hasanamini@ut.ac.ir), **Codex Paris 772 as a source for History of Mathematics**

Collection number 772 of Bibliothèque nationale de France includes 27 scientific treatises, mainly Persian mathematical texts. The manuscript is attributed to Abū Isḥāq ibn ’Abd Allāh al-Kūbanānī al-Yazdī, a fifteenth-century Iranian scholar. al-Kūbanānī was a literary man, skilled also in mathematics and astronomy. His letters and most of his mathematical and astronomical works have remained. The collection 772 is not of his works, but on the other hand, of the works that he considered as essential. Historically speaking, this manuscript, collected and scribed by a teacher-scholar, is a source for not only understanding its mathematical content, but also considering the mathematics in its context. In this talk, the collection's content will be analyzed upon the subjects and purposes of treatises to show what was considered as the role of mathematics during this time.

Christopher Baltus, SUNY Oswego (christopher.baltus@oswego.edu), **Was Jacob Steiner a cofounder of projective geometry?**

The main works to be considered are Jean-Victor Poncelet’s *Traité des Propriétés Projectives des Figures* of 1822 and Jacob Steiner’s *Systematische Entwicklung de Abhängigkeit geometrischer Gestalten* of 1832. By a quick look, Poncelet’s 1822 treatise most resembles work by Lazare Carnot in the first decade of the nineteenth century, except that Poncelet solved a number of problems by letting a line of a given figure “pass to infinity.” Steiner’s 1832 work, on the other hand, appears to belong to the group of texts on projective geometry that would appear in large numbers in the late nineteenth century and throughout the next century. The difference is more than superficial. The crucial difference involves the projective transformation that Poncelet called a homology. Projection for Poncelet was based on a plane-to-plane projection, where the planes meet in a line l. When one plane is rotated about l to coincide with the other plane, we still have a collineation with an axis, l, of fixed points. That is the modern definition of a perspective collineation. He did consider line-to-line projection, but only as part of a plane-to-plane projection. And, crucially, he generally did not consider composition of homologies. Steiner, on the other hand, started with elementary forms, *einleitende Begriffe*, including the line of points and the pencil of

lines, *Strahlenbüschel*, and listing ways these are related by a perspectivity. Then a projectivity is the composition of perspectivities. Only Steiner would take up the question of when a particular pairing of points on two lines is a projectivity. (His answer: when the cross-ratio of any four points is invariant in the pairing.)

David Bellhouse, University of Western Ontario (bellhouse@stats.uwo.ca), **The Evolution of the Field of Statistics: A Case Study from Twentieth-century Manitoba**

Is the field of statistics a branch of mathematics? Or is it something else? I examine this question by using the Province of Manitoba as a case study with data collected from between 1910 and 1980. The data, mostly collected online because of the pandemic, come from three major sources: digitized Winnipeg city directories up to about 1965, digitized Manitoba newspapers covering the whole period, and University of Manitoba calendars, as well as other material found online and some personal interviews. The concept of what is statistics has changed since the term was first coined in English in 1770. And it continues to change. Originally, it concerned information about the state. In the later nineteenth century, it was seen as part of sociology, then of economics. By 1960, "modern" statistics in Canada was recognized succinctly as "probable inference from numerical data." My current understanding of the field is that statistics is, or is closely related to, the new catchphrase "data science". By using the source material to find those who self-identify as statisticians, I examine the evolution of statistics and the categorization of those working in the field as blue-collar and white-collar statisticians.

Gregg De Young, American University in Cairo (gdeyoung@aucegypt.edu), **Changing perspectives on the medieval transmission of Euclid's *Elements***

The historian's view of the early transmission of Euclid's *Elements* from Greek into Arabic has often been shaped by the 4th / 10th-century report in al-Nadim's *Fihrist* describing two translations, one by al-Ḥajjāj ibn Yūsuf ibn Maṭar and one by Isḥāq ibn Ḥunayn, each subsequently being revised. All surviving Arabic manuscripts of the *Elements* were thought to have descended from the translation of Isḥāq, as revised by the mathematician Thābit ibn Qurra. Recent discoveries have begun to call this assumed transmission into question. Two recently discovered manuscripts diverge from the known Isḥāq-Thābit transmission, offering new insights into the features of the Ḥajjāj transmission. A new research initiative (by Ofer Elior), based in Israel, has recently published the first installment of a long-term project to edit two of the most widely read and copied medieval Hebrew versions of the Euclid's treatise. This edition will not only reshape our view of the medieval Hebrew transmission but also provide new insights into the Arabic and Latin transmissions with which the translators of the Hebrew text interacted.

David Dunning, Oxford University (david.dunning@maths.ox.ac.uk), **Constructing the 'Home-side' of a Scientific Legacy: Mary Everest Boole, Pedagogy, and Domesticity**

The Victorian writer Mary Everest Boole (1832–1916) developed an idiosyncratic pedagogical treatment of arithmetic, algebra, and logic. Her pedagogy favored active, child-directed learning, and is now generally admired as ahead of its time, though it must be deciphered through fairly eccentric delivery. A recurring theme in Mrs. Boole's prolific writing is the misunderstood legacy of her late husband, the renowned mathematician and logician George Boole (1815–1864). As existing literature has shown, she worked to promote a morally and religiously charged understanding of his work. The present paper emphasizes a distinct but related feature of her outlook, namely her all-encompassing pedagogical perspective on Dr. Boole's life and work. Across her voluminous publications, Mrs. Boole filtered everything—mathematics, logic, religion, morality, and homelife—through the lens of pedagogy. I argue that she used this expansive conception of teaching to span the gulf between professional and domestic work, thereby claiming a privileged domestic perspective on her husband's intellectual output and enlisting his legacy as a resource for her own writing.

Iman Ferestade, Simon Fraser University (iman_ferestade@sfu.ca), **Do engineers really know what they are doing?**

The question of how scientists obtain knowledge from running computer simulations and what justification is in these simulations has received much attention in recent years. In the literature on computer simulations, some try to show that knowledge about the results of computer simulations is grounded in the knowledge of the process in which computer simulation results are achieved. In this way, they try to shed light on the process' opacity to see what happens during computer simulations and how the true result is achieved through input data. I call these efforts internalist epistemic accounts of computational simulations. In my paper, I show two main problems with these accounts. First, they cannot justify the results achieved by computer simulation for a single problem with different degrees of freedom modeling. Second, based on these accounts, the knowledge of computer simulation results becomes exclusive to some specialists, which leads to accepting the counterintuitive result that engineers who use computational methods in their research typically don't know what they have achieved using computer solutions. I then introduce an externalist account of computer simulation that deals with these issues based on the residual. The goal of my account is not to make the process of computer simulations transparent nor to find the ground for computer simulations results. In my account, the results of computer simulations are knowledge, since they are gained through a reliable process by checking the residual to see whether its value is sufficiently small.

Nicolas Fillion, Simon Fraser University (nfillion@sfu.ca), **Pedagogy and curriculum in intermediate logic courses**

Most institutions offer an introductory logic course in one or more departments, sometimes followed by more advanced logic courses. However, because of pedagogical and curricular decisions made by textbook authors and instructors, such courses often provide only limited benefits for most students. In this talk, I will present the guiding principles as well as the curricular structure and some of the main pedagogical innovations I have developed for an intermediate logic course (and for the accompanying free textbook). The course is "intermediate," in the sense that it fits most naturally between an introductory course and a metalogic course, at least following the most usual progression. However, the course is also suitable for students who have received a modicum of logic backgrounds in classes offered in mathematics, computer science, or linguistics (to take a few of the more common examples) and, as a result, can generate good upper-year enrolment. The focus of the entire course is to learn how to systematically find and communicate proofs—as they are requested in assignments in mathematical disciplines. The content consists in a sequence of topics including sentential logic, predicate logic, and axiomatic set theory up to recursion & choice—but importantly for students, in a way that avoids standard foundational "loops" and methodologically circular presentations (e.g., logic founded in set theory, and set theory founded in logic).

Craig Fraser, University of Toronto (craig.fraser@utoronto.ca), **Original Sources in Research Mathematics: The Case of Hamilton-Jacobi Theory circa 1900**

Mathematicians who are engaged in ongoing research tend to draw on fairly recent work that has been carried out in the previous few years. Nevertheless, there is even within this context such a thing as "an original source," usually a foundational work that appeared sometime further back in the past and whose existence is well known and which is viewed as an historical marker. Of interest are how the older sources are presented in research papers and in the advanced textbook literature. Our case study concerns dynamical analysis in the early years of the twentieth century, with a focus on Hamilton-Jacobi theory. For researchers around 1900 the papers and writings of William Rowan Hamilton and Carl Gustav Jacobi from the 1830s constituted original or primary sources. We explore how these later researchers understood and drew on the formative older works, both in their journal publications and in broader expository writing. Figures of interest from around 1900 are Henri Poincaré, Carl Charlier, Edmund Whittaker, and, from somewhat later, Arnold Sommerfeld, Max Born, and Constantin Carathéodory. It is also of interest to consider the historical writings of mathematicians and examine how they understood and interpreted their sources. A relevant example is Felix Klein's *The Development of Mathematics in the 19th Century* (1926), which included a part on Hamilton-Jacobi theory.

Emmylou Haffner, École Normale Supérieure, Paris Sciences et Lettres (emmylou.haffner@ens.psl.eu), **Going to the source(s) of sources in mathematicians' drafts**

The mathematical text in its published form, as we are most used to reading it, is a carefully structured and polished means of communicating results to the scientific community. It is, as Reuben Hersh put it, the 'front' of mathematics. In this talk, I would like to look at the 'back' of mathematics, at what happens in the privacy of drafts, which can certainly be seen as the mathematician's laboratory. Considering that these preliminary texts are a part of the mathematical practice—and indeed a crucial one—I will show that they allow us to understand the shaping of mathematics in deep and significant ways. Using a selection of examples, I will focus on questions related to the materiality of mathematical texts, how textual elements and mathematical practices work with each other, the process (or processes?) of writing in mathematics, and the choices made in writing a text deemed suitable for communication to the scientific community.

Emily Hamilton, University of Massachusetts, Amherst (ehamilton@history.umass.edu), **It's 6am. Do You Know Where Your Calculus Teacher Is?**

In the past two years, parents of school-aged children, school boards, and educators have seen a sharp uptick in digital learning. Certainly, these pedagogical innovations will have a place in future teaching; however, these multimedia strategies to enhance classroom learning have a long history. In this paper, I argue that early efforts to improve mathematical curricula at the K-12 level in the United States coincided with innovative proposals to develop educational programming in mathematics at all levels on film and television, prior to comparable developments in children's programming around literacy. In 1957, for example, at a conference held at Walter Reed Hospital outside of Washington, D.C., a tentative agreement was reached that a televised lecture series—originally thought to be based on the principles of calculus—be filmed at the University of Maryland and released for the 1957–1958 academic year, aimed at high school teachers as a form of professional development. One of the members of this group "expressed the conviction that this would be very popular with teachers"; another indicated a "special personal interest in this type of course by television." In this early meeting, no further justification appears to be presented—anecdotal interest seems to drive the development of this type of programming. This ambitious project, intended to one day be televised beyond a local audience, followed in the footsteps of a surprising number of film and televised educational programming developed at around the same time, with groups like the Educational Advisory Board of the National Academy of Sciences, the NEA, MAA, the AAAS, and local groups such as the Wisconsin Mathematics Council (among many others) all enthusiastically pursuing recorded mathematics instruction for students and teachers at the K-12 level—at times with (relatively) impressive institutional funding. This paper serves to outline these film and television projects in a historical context, placing them alongside the history of educational reform that expanded rapidly in the post-war American context—earlier and more rapidly than the more high-profile education reforms in the sciences. Importantly, however, the Canadian Society for History and Philosophy of Mathematics is the ideal location to first announce my work in this area, as initial research demonstrated that TV Ontario was a prominent distributor of educational programming in mathematics, including the well-known *Math Patrol* program used widely in Canadian classrooms and aired by the public broadcaster. Today, mathematics programming has expanded to the internet, and is featured heavily in supplementary pedagogical programming such as Khan Academy and remote-schooling-compatible packages. This paper explores the historical roots of and impetus for the development of non-classroom pedagogical materials and examines the historical actors involved in their production.

Cynthia Huffman, Pittsburg State University (cjhuffman@pittstate.edu), **Mathematical and Philosophical Imagery in Original Sources Related to Émilie du Châtelet**

Emblematic imagery was prevalent in scientific books in the 16th and 17th centuries, with symbolism appearing in frontispieces, illustrated title pages, and other images. Images, mottoes, and poems were used to help elucidate concepts, connections, and hidden meanings, as well as to provide a preview of the contents of the book. Although the French mathematician and philosopher Émilie du Châtelet, a significant figure in the Enlightenment, lived in the 18th century, emblematic imagery can be seen in her works, as well as in the works of others connected to her. In this presentation, we will give a brief biography of Émilie du Châtelet before delving into an analysis of examples of mathematical and philosophical imagery in original sources authored by Émilie du Châtelet and her colleagues, including the French philosopher and author Voltaire and the Italian polymath and philosopher Francesco Algarotti.

Chanwoo Lee, University of California, Davis (owclee@ucdavis.edu), **Foundation as Scaffolding**

The notion of 'foundation' in mathematics can be ambiguous; there may not be a single sense of 'foundation' under which all relevant mathematical and philosophical approaches fall. I suggest that how we conceive 'foundation' can help us determine what roles we can expect from a foundational account. Specifically, I characterize the 'scaffolding' conception of foundation. We can conceive of a foundational account as what entitles us to have a certain cognitive stance toward the mathematical theory without constituting the theory's content in itself. This is to be contrasted with what I call the 'building block' conception. I further argue that the scaffolding conception is tenable in two distinct philosophical contexts. First, I present reasons why the practice-oriented approach to philosophy of mathematics supports the scaffolding conception. Second, given that foundational accounts typically involve inter-theoretic reduction, I show that we can understand the practice of reduction in a way that aligns with the scaffolding conception. As a case study, I consider the problem of whether a category-theoretic foundation can be autonomous. I argue that the scaffolding conception can be aptly applied to the problem, allowing us to respond to some influential objections to the autonomy of category-theoretic foundation.

Patricia Marino, University of Waterloo (pmarino@uwaterloo.ca), **On the Use of Mathematics in Economics: Formalism, Fit, and Physics**

This paper draws on work in philosophy of mathematics to consider debates over the use of mathematics in economics, especially those concerning claims that the use of mathematics in economics is too "formalistic." Vela Velupillai and co-authors Thomas Boylan and Paschal O'Gorman argue that classical mathematics is inappropriate for use in economics, that appealing to formalist foundations of mathematics is part of the problem, and that intuitionistic foundations and constructive mathematics should be adopted instead. In the background is longstanding debate over whether contemporary economics is "too formalistic"—cut off from empirical justification, with models created as part of a "game." I consider 1) how work in philosophy of mathematics bears on these claims, 2) what Roy Weintraub's distinction between formalism in foundations and formalism as axiomatization tells us here and 3) what these investigations tell us about the charge of "formalism." I argue that aptly understood these problems have to do not with foundations but rather with choosing the right mathematical tools and with broader questions about "axiomatizing" a science. A potential emergent line of thought is that limited potential for experimentation hinders attempts to explain a wide range of phenomena on the basis of a few principles.

G. Arthur Mihram and Danielle Mihram, University of Southern California (dmihram@usc.edu), **Limited Roles for Mathematics in Science and in Academic Curricula**

Science is that human activity devoted to the search for the very explanation for (i.e., for the truth about) any particular naturally occurring phenomenon. Four points: 1. Mathematics is a language (artform) useful for its grammatically third-person conveyance of a scientist's model, but it is neither necessary (e.g., Nobel Laureate Konrad Lorenz, Charles Darwin), nor is it sufficient (e.g., Euclid) for Science. 2. Our Modern Science's 'Method', as historically deduced from the history of Science, is herein shown to be a six-stage model-building process, including its two historical 'correctives': logico-grammatical rectitude; and the need for any logically correct deduction emanating from any model to be confirmed by Nature. 3. The six stages, with their two "feedback loops" in Science, are shown to be rather exactingly miming each of two biological processes for species' survival: First, chemico-genetic model-building, conducted (without cognizance) by every species' genetic system/'memory'; and, second, chemical-mental model-building, conducted by any of the 'higher' animal species (those with memory-and-recall capability). 4. Additionally, the persistence historically of mathematics in both secondary and tertiary educational curricula, arises from its continuing to serve in the disciplining of the adolescent mind in reaching impeccably logical conclusions (required by Science), hopefully throughout his/her adulthood.

Jorge Nuno Silva, University of Lisbon (jnsilva@cal.berkeley.edu), **Who was able to perform multiplication and division of large numbers by the year 1 CE? And by the year 1000 CE?**

Calculation tables and abaci were used for calculations for centuries. Before the spread of the Hindu-Arabic numerals, and the positional numeration system, that made it possible for everyone with pencil and paper to calculate, how were multiplications and divisions of large numbers done, if at all? Could the Romans (around 1 CE) use their numerals for big calculations? How did they manage? Or did they? What was Gerbert's abacus (around 1000 CE) and where did the procedures associated with it come from? We will approach these questions and try to provide some tentative answers.

David Orenstein, Danforth CTI, Emeritus (david.orenstein@alumni.utoronto.ca), **The 1992 Quebec City International Congress on Mathematical Education (ICME) / Le Congrès international sur l'enseignement des mathématiques (CIEM) de 1992 à Québec**

In August 1992, the 7th/ème International Congress on Mathematical Education / Congrès international sur l'enseignement des mathématiques (ICME/CIEM) took place at Quebec City's Laval University. ICMEs are quadrennial events alternating with the better-known International Congresses of Mathematicians / Congrès international des mathématiciens (ICM/CIM). They come under the auspices of the International Commission on Mathematical Instruction (ICMI), which came out of the 1908 Rome ICM. Though Canada had hosted the ICM, first at Toronto in 1924, and in Vancouver in 1974, Quebec City was the first Canadian ICME.

Attendance and participation were quite international (3407 delegates, 94 countries), but with significant strengths and weaknesses. The anglophone world (1988 from Canada, UK, Aust., NZ, USA) was especially well represented, but so was la Francophonie (174, excl. Canada) and, surprisingly, Israel (49). Just two years after the collapse of the Soviet Union, the turnout from Russia (10) and its neighbours (FSU = 7) was rather small. Just like the host country Canada, the Congress and its *Proceedings* were fully French/English bilingual. The two-volume *Proceedings* summarises events in one, and provides the complete texts of 27 of the invited lectures in the other. Plenary lectures were delivered by Geoffrey Howson and Benoît Mandelbrot. There was a tribute dinner for U of T geometer H.S.M. Coxeter. Lectures on teaching geometry, mathematics as language, appreciating theorems, mathematics and the Global Village, etc. A plethora of workshops: Math concepts at the primary level, project work, statistics for the citizen, etc.

Well into my own career as a Canadian high school mathematics teacher in 1992, I now look at how well this ICME dealt with issues that I was encountering. Today the 1992 approach seems both very prescient and also somewhat dated. Gender issues, for example, were only about men and women. Or discussions of exciting new technologies, now obsolete.

Le Congrès international sur l'enseignement des mathématiques (CIEM) de 1992 à Québec *de* **David Orenstein** *(émérite, Danforth ICT; Toronto, Ontario, Canada)*

En août 1992 le 7ème/th Congrès international sur l'enseignement des mathématiques / International

Congress on Mathematical Education (CIEM/ICME) a eu lieu à l'Université Laval de Québec. Les CIEMs sont des événements quadriennaux, en alternance avec les Congrès international des mathématicien / International Congresses of Mathematicians (ICM/CIM) mieux connus. Les CIEMs sont sous l'égide de la Commission internationale de l'enseignement mathématique. Née de la CIM de 1908 à Rome. Même que le Canada a été l'hôte de deux CIMs, ceux de Toronto en 1924 et de Vancouver en 1974, le CIEM de Québec était le premier au Canada.

L'assistance et la participation étaient très internationales (3407 délégués, 94 pays), mais avec des puissances et des faiblesses. L'anglophonie était bien en place avec 1988 délégués du Canada, et du Royaume-Uni, et de l'Australie, et de la Nouvelle-Zélande, et des États-Unis; mais aussi la Francophonie avec ses 174 délégués, sans les Canadien(ne)s, et 717 y avec. Il y avait 162 Scandinaves et même 49 Israélie(ne)s. Deux ans après l'effondrement de l'Union Soviétique, de la Russie il y avait seulement dix délégués, et sept de ses proches voisins.

Comme le Canada, le pays hôte, le Congrès et ses *Actes* étaient pleinement bilingue, français/anglais. Les *Actes,* en deux tomes, résument les événements au premier, et présentent au complet 27 des conférences invitées au deuxième. Il y avait des conférences plénières de Geoffrey Howson et de Benoît Mandelbrot. Il y avait un dîner en hommage au géomètre renommée de l'Université de Toronto, H.S.M. Coxeter. Conférences au sujet de l'enseignement de la géométrie, les mathématiques come langue, aimant les théorèmes, les mathématiques et le Village global, étc. Une pléthore de groupes de travail: concepts mathématiques au niveau primaire, enseignement par projets, les statistiques pour l'adulte de demain, etc.

En 1992, j'étais un professeur des mathématiques au niveau secondaire assez bien expérimenté. Aujourd'hui, je me demande si l'ICME de Québec s'adressait aux problèmes que je rencontrais à l'école. Les questions du genre, par exemple, s'agissaient seulement des hommes et des femmes. Ou les séances au sujet des technologies de pointe, maintenant désuètes.

Jean-Charles Pelland, University of Bergen (Jean.Pelland@uib.no), **Recipes for talking about mathematical progress**

If foundational issues monopolized the philosophy of mathematics at the turn of the 20th century, its focus has now successfully been broadened to include investigation into the practices of real-life mathematicians. While this is certainly a welcome change, there are cases where the notion of practice appears ill-suited to characterize the actions of a mathematical agent. The problem is that practices are typically held to be social structures composed of repeated performances of the same actions (e.g. Rouse 2006). A practice-based framework makes it difficult to identify the processes responsible for the generation of novel methods and new theorems. While it is tempting to appeal to the well-known parallels between biological and cultural evolution (e.g. Richerson & Boyd 2005; Mesoudi et al. 2006) to find a mechanism capable of generating novel practices, in this talk I argue that accounts of cultural evolution do not have a specific process equivalent to genetic mutation that could serve to explain where novelty comes from. I then explore the potential advantages of using the notion of cultural recipes (e.g. Charbonneau 2016; Schiffer and Skibo 1987) instead of that of practices.

José Antonio Pérez Escobar, École Normale Supérieure, Paris Sciences et Lettres (jpe460@gmail.com), **Showing mathematical flies the way out of foundational bottles: the later Wittgenstein as a forerunner of Lakatos and the philosophy of mathematical practice**

This work explores the later Wittgenstein's philosophy of mathematics in relation with Lakatos' philosophy of mathematics and the philosophy of mathematical practice. I argue that, while the philosophy of mathematical practice typically identifies Lakatos as its earliest of predecessors, the later Wittgenstein already developed key ideas for this community a few decades before. However, for a variety of reasons, most of this work on philosophy of mathematics has gone relatively unnoticed. Some of these ideas and their significance as precursors for the philosophy of mathematical practice will be presented here, including a brief reconstruction of Lakatos' considerations on Euler's conjecture for polyhedra from the lens of late Wittgensteinian philosophy. Overall, this article aims to challenge the received view of the history of the philosophy of mathematical practice and inspire further work in this community drawing from Wittgenstein's late philosophy.

Dirk Schlimm and David Waszek, McGill University and CNRS, Archives Henri Poincaré – Nancy, France (dirk.schlimm@mcgill.ca), **John Venn's pluralism regarding logical forms**

By the second half of the 19th century, various frameworks for formal logic had emerged in Britain, such as different treatments and extensions of Aristotle's syllogisms, an interpretation of the subject-predicate structure of propositions in terms of classes, and Boole's symbolic logic together with further developments it sparked. John Venn (1834–1923) proposed his famous diagrams as an illustration of one of these frameworks. What makes him stand out from his contemporaries is his pluralist attitude towards logical forms, which we present in this paper. Instead of arguing for the superiority of one of them, Venn carried out a systematic comparison in terms of their underlying principles and carefully discussed their advantages and disadvantages with respect to each other. The fact that he did not find one of them superior in all respects led him to adopt a pluralist attitude towards the analysis of logical propositions.

J.J. Tattersall and S.L. McMurran, Providence College and California State University, San Bernardino (TAT@providence.edu), **Cambridge Women's Research Club**

Independent clubs, societies, and associations are no strangers to colleges and universities. For example in Cambridge, England, prominent groups that come to mind include the Analytical Society, the Footlights Dramatic Club, the Cambridge Union Debating Society, and the Cambridge Apostles. Less well known perhaps are the Cambridge Ladies Dining Society, the Del Squared V Club, and the Cambridge Women's Research Club. While the first two are of interest, we highlight the Women's Research Club, whose membership over its sixty-year existence was only open to local women academics. We describe its activities, impact, and eventual demise.

Valérie Lynn Therrien, McGill University (valerie.l.therrien@mcgill.ca), **The Evolution of Cantor's Proofs of the Non-Denumerability of $\mathbb{R}$**

The primary aim of this paper is to track the evolution of Cantor's proofs of the non-denumerability of $\mathbb{R}$—which culminates in the famous diagonal argument and Cantor's Theorem. Why did Cantor revisit his proof three times? The secondary aim of this paper is to explore the heuristic role of arrays in his proof of the non-denumerability of $\mathbb{R}$. Why did Cantor return to the infinite array he had abandoned for his first two versions of the proof? I will conclude that Cantor likely had the means to arrive at the diagonal argument by 1878, but that the ways in which he had been using arrays up until then would have involved arbitrarily constructing an irrational number simply by manipulating numbers as if they were mere symbols. While this may seem natural to us now, this would not have been an acceptable way to construct an irrational number to his peers. Cantor's lengthy absence from public mathematics likely provided him with the time required to distill the essence of the diagonal argument, and to produce a proof that did not require the construction of an irrational number at all.

Julia Tomasson, Columbia University (Jct2182@columbia.edu), **Reading Uqlidis in New York: The Making and Unmaking of "The Arabic Euclid" in Columbia University's Rare Book and Manuscript Library**

Euclid's *Elements* is one of the most important and most studied books in the history of mathematics, education, and the production and transmission of knowledge more broadly. However, markedly less well studied is its role and importance in the Islamicate world. This talk has two aims. First, I will trace the history of Columbia University's extensive collection of extant editions of Euclid, focusing on George Arthur Plimpton's quest to collect editions of Euclid in Arabic in service of uncovering what he called "the Arabic Euclid." Second, I will perform a formal analysis of a selection of Arabic translations and commentaries of Euclid's *Elements* (*Uṣūl al-handasah*) focusing on their structure, translation of axiomatic language, and diagrams. Ultimately, I will argue that these manuscripts by Uqlīdis (the Arabization of Eukleides or Euclid) are not just important translations and links in the chain of transmission of Euclid, but also constitute a distinct tradition of Euclidean mathematics that we should take seriously as such. Further implications will also be discussed for i) *methodologies* we use in studying non-western mathematical texts, ii) understanding the *history* of the transmission and reception of Greek mathematics, and iii) different philosophies of mathematical learning, demonstration, and progress.

Mario Bacelar Valente, Pablo de Olavide University (mar.bacelar@gmail.com), **Ancient Greek mathematical proofs and metareasoning**

We present an approach in which ancient Greek mathematical proofs by Hippocrates of Chios and Euclid are addressed as a form of (guided) intentional reasoning. Schematically, in a proof, we start with a sentence that works as a premise; this sentence is followed by another, the conclusion of what we might take to be an inferential step. That goes on until the last conclusion is reached. Guided by the text, we go through small inferential steps; in each one, we go through an autonomous reasoning process linking the premise to the conclusion. The reasoning process is accompanied by a metareasoning process. Metareasoning gives rise to a feeling-knowing of correctness. In each step/cycle of the proof, we have a feeling-knowing of correctness. Overall, we reach a feeling of correctness for the whole proof.

We suggest that this approach allows us to address the issues of how does a proof function, for us, as an enabler to ascertain the correctness of its argument, and how do we ascertain this correctness.

Glen Van Brummelen, Trinity Western University (Glen.VanBrummelen@twu.ca), **Hidden in the Manuscripts: How Bianchini's Texts were Read and Used**

Like many historians of mathematics, I was trained in a mathematics department. This helped to shape my predilections, leaning me toward the mathematical content that my manuscripts contain, rather than what may be found in the manuscripts themselves as physical objects. My current involvement in a large project on Alfonsine astronomy has put me in contact with experts in codicology, and opened up new windows for me into learning how the 15th-century astronomer Giovanni Bianchini's works were read, studied, and used. We shall compare the structures of several manuscripts, noting substantial differences between them that reflect their composers' differing interests in the texts. The manuscripts inform us that Bianchini may have been a polarizing figure, requiring his readers to make a choice: go "all in" on his approach to astronomy, or drop him altogether in favour of more conventional authors.

Ruigang (Paul) Xu, McGill University (ruigang.xu@mail.mcgill.ca), **Hugh MacColl and Counterpossibles**

Hugh MacColl (1837–1909) was one of the early logicians interested in developing a symbolic system of logic. Among his many innovative contributions, one of the most striking elements is his discussion of the possibility of reasoning non-vacuously about impossibilities. In this talk I will provide an explication of MacColl's proposal in terms of counterpossibles, conditionals whose antecedents are logically impossible. Counterpossibles are standardly understood as vacuously true on account of their logical forms, and as a result any inference from counterpossibles must be trivial. Non-vacuism, the view that counterpossibles are not (always) vacuous, is typically motivated by two kinds of evidence: conversational data and proofs by reductio, neither of which seems to be what motivates MacColl. I will discuss MacColl's novel grounds for defending non-vacuism and argue that his attitude towards counterpossibles is shaped by his permissive view on the subject area of logic.

Maria Zack, Point Loma Nazarene University (mzack@pointloma.edu), **Blaise Pascal, Amos Dettonville, and the Roulette**

In June of 1658, using the pseudonym of Amos Dettonville, Pascal issued a challenge offering 40 pistoles to the first person who could solve a collection of six problems related to the cycloid. The solutions were to be submitted to the mathematician Pierre de Carcavi by October 1 of 1658. Carcavi was named as the judge of the contest and served as the conduit for communication between the contestants and Dettonville. This talk will discuss the problems in the challenge, the responses that were submitted and Pascal's own publications in the cycloid.