ICHM

Report on the ICHM Co-Sponsored AMS-MAA Special Sessions on History of Mathematics

Joint Meeting of the American Mathematical Society and the Mathematical Association of America

San Diego, CA; January 11-12, 2013

Adrian Rice

This set of lectures comprised a two-day Special Session on the History of Mathematics at the Joint Meeting of the American Mathematical Society and the Mathematical Association of America held at the Convention Center in San Diego, California, USA.

The session organizers from left to right: Patti Hunter, Deborah Kent and Adrian Rice

The session was organized by Patti Hunter (Westmont College), Deborah Kent (Drake University) and Adrian Rice (Randolph-Macon College) and featured the following speakers and talks:

Algebra in Words vs. Algebra in Symbols

Victor J. Katz, University of the District of Columbia

Is it an "algebra problem" if both the statement and the solution are given entirely in words? This question has been debated by historians studying the development of algebra and trying to decide on its origins. If symbolism is an essential facet of algebra, as some historians claim and as we normally teach algebra today, then it cannot be said to have begun much earlier than the beginning of the seventeenth century. So did Islamic mathematicians beginning in the ninth century actually do algebra, given that their work was entirely verbal? This talk considered some aspects of the history of solving problems for unknown values in medieval Islam and in late medieval Europe and attempted to develop some reasonable answers to the above questions. It also looked at the difficulties that "algebra in words" presented to Islamic mathematicians and raised the question as to whether the lack of symbolism in Islamic mathematics was in part responsible for its failure to develop further than it did.

Riches from the Middle Ages

Barnabas B. Hughes, California State University, Northridge

An immobile circular slide rule from the Jewish quarter, the challenge for truth from the Moslem stance, beginning to compute with signed numbers from a European Christian: these vignettes were shared, enriched with another four or five from a treasury of medieval mathematics (800-1470), including the finite birth of infinite series.

Great minds think alike – when they share knowledge

Janet L. Beery, University of Redlands

Matthias Schemmel has written about the "shared knowledge" of Thomas Harriot (1560-1621) and Galileo Galilei (1564-1642) and their resulting theories of projectile motion, and Kathleen Clark and Clemency Montelle have written about the "parallel insights" of John Napier (1550-1617) and Joost Burgi (1552-1632) on logarithms. This presentation illustrated the shared knowledge and parallel insights of Harriot and Galileo, Harriot and Johann Faulhaber (1580-1635), and Harriot and Bartholomaus Pitiscus (1561-1613) about, respectively, models of projectile motion, formulas for generalized triangular numbers (binomial coefficients), and constant difference interpolation techniques.

What mathematics did George Washington know before he became a professional surveyor and how did he use it?

V. Frederick Rickey, United States Military Academy, and Theodore J. Crackel, The Papers of George Washington

Between the ages of 13 and 15, George Washington compiled two cyphering books consisting of 180 manuscript pages. Whether he learned mathematics from tutors, from teachers, from his half-brother Austin, or on his own from various books, we do know that he mastered a good deal of arithmetic, geometry, logarithms, trigonometry, surveying and other material. We described in detail what he learned and show how he used it—or did not use it—in the youthful surveys in his cyphering books.

Mathematics is a Plural Noun: The Case of Oliver Byrne, Esq.

Janet Heine Barnett, Colorado State University - Pueblo

Histories of mathematics often focus on major names and developments, as these appear from the perspective of academic mathematics in the historian's own time. Ignored are the 'lesser' practitioners of mathematics who worked alongside the better known names. Yet the activities of lesser lights can reveal aspects of the history of mathematics otherwise hidden from view. This talk casts a spotlight on one such figure: the elusive Oliver Byrne, Esq. (*c*.1810-1875).

A self-educated engineer, self-proclaimed mathematician and prolific technical author of Irish heritage, Byrne is most remembered for his beautiful 1847 *Euclid by Colour*. His other publications suggest Byrne himself would rate his contributions to computational practice to be of even greater merit. He took particular pride in his ‘Dual Arithmetic,’ a system of computation that he initially proclaimed to “entirely supersede the use of logarithms” and later developed into an elaborate system of ‘dual logarithms.’

This talk surveyed Byrne’s mathematical works and their reception within the increasingly stratified community of 19th-century British mathematical practitioners. In particular, we considered De Morgan’s opinion of Byrne’s work and reflected upon what it reveals about professional mathematics at the time.

Mathematical questions: A convergence of practices in British mathematical journals, 1795-1901

Sloan E. Despeaux, Western Carolina University

The persistence and wide-ranging popularity of the “questions and answers” format in British mathematical journals from 1795 to 1901 can be viewed as a convergence of two different mathematical practices: (1) the recreational problem-solving tradition supported by the almanacs of the 18th century, and (2) the problem-solving tendencies and tastes of Cambridge graduates and the students of these graduates. These tendencies and tastes were encouraged through the conversion of the Cambridge Tripos to a paper-based examination at the turn of the 19th century and the subsequent diffusion of paper-based examinations throughout Britain during the second half of the 19th century. This paper traced the “questions and answers” format from 1795, when Thomas Leybourne began his *Mathematical and Philosophical Repository*, to 1901, when the first series of the *Mathematical Questions . . . from the “Educational Times”* ended. The convergence of these two practices resulted in the persistence of a particular method for mathematical communication and discovery that resisted the stratifying forces of professionalization.

Mathematical Publication in Early Nineteenth-Century Germany: Venues, Careers and Publics

William Thomas Archibald, Simon Fraser University

This paper was devoted to the following question; if one wanted to publish a mathematical article in Germany in the nineteenth century prior to *Crelle’s Journal*, what would one do? I first considered the question of mathematical production and its purposes more generally at this period. The context in the period before, during and following the Napoleonic wars is particularly important. This was particularly the case for those who worked with mathematics in its various forms, for the key roles of mathematics in geodesy and navigation had made it the premier and foundational military art, useful also in all forms of construction and industry.

In the paper we took a look at where, how, and why mathematical work was published, considering careers to remind ourselves of their heterogeneous character, to identify publics and motivations for reaching them, and to be able at least to reflect, if without much actual data, on the economics of publishing mathematical works.

Why Natural Numbers Are Called Natural: The Impact of Social Context in Nineteenth-Century Mathematics

Andrea Arredondo, Instituto de Investigaciones Filosóficas, UNAM, Mexico City, Mexico

Natural numbers have been the main subject of a great variety of studies. However, the reason why they were called natural numbers has received little attention. In order to understand how natural numbers became natural, it is necessary to look back at the nineteenth-century German states. It is within this background that the term natural number appears for the first time in the works of Carl Friedrich Gauss, Hermann von Helmholtz, Leopold Kronecker, Gottlob Frege, and

Richard Dedekind. But why did they refer to natural numbers in that way? My aim is to show that the naturality of natural numbers is not merely a result of mathematical insights, but that it is possible to see it as the product of a mixture of political, academic, and cultural forces. Transformations in education and a renewed humanism in the German states of the nineteenth-century shaped the way in which knowledge was pursued. Accordingly, certain visions of how and what was studied were privileged. German mathematicians did not escape from the influence of those visions. Ultimately, they were directed towards a specific conception of logic which not only served as a foundation for natural numbers, but made of them a natural consequence of the human mind.

Analytic representation and the Mittag-Leffler “circle”: Contrasting notions of generality in the late 19th century

Laura E. Turner, University of Toronto

Mittag-Leffler developed the theorem which bears his name between 1876 and 1884, following his apprenticeship in Berlin under Weierstrass, whose Factorization Theorem served as the point of departure for Mittag-Leffler’s work. Where Weierstrass developed a representation for entire functions which displayed their zeros and their multiplicities, Mittag-Leffler focused on the analytic representation of functions with the most extensive possible set of singularities with the aim, from at least 1877, of representing those with even infinitely many essential singularities. To Mittag-Leffler and Weierstrass, such analytic representations, fundamental to the Weierstrassian definition of a function itself, formed the most general “unit” of analysis. Indeed, studies devoted to the representation of functions were mainstream during this period. Yet others, and Cantor in particular, saw this dependence on analytic representations as problematic. His correspondence with Mittag-Leffler illuminates a shifting understanding of what it meant to be “general”, or “more general” in mathematics.

In this talk, I discussed the concept of “generality” foundational to the Mittag-Leffler Theorem, and considered the importance of this concept to some of Mittag-Leffler’s contemporaries.

Mathematical Notations as Identifiers of Epistemic Cultures

Bruce J. Petrie, University of Toronto

Michael Mahoney (1993) observed that “The symbols and terms of modern mathematics are the bearers of its concepts and methods. Their application to historical material always involves the risk of imposing on that material a content it does not in fact possess.” In making this observation Mahoney was influenced by Thomas Kuhn’s writings on scientific change. *Revolutions in Mathematics* (Gillies, 1992) is a book dedicated to the integration of Kuhnian historiography and the history of mathematics. While Kuhn is well known, many historians of mathematics have yet to be introduced to the ideas of Karin Knorr Cetina, as presented in her *Epistemic Cultures: How the Sciences Make Knowledge* (1999). Knorr Cetina suggests that Kuhnian historiography is too narrow and proposes an alternative to the paradigm concept, that of epistemic culture. This paper documented the relevance of Knorr Centina’s conceptions to the history of mathematics and argued that there is an important reason to respect the distinctive notation and terminology of past mathematics: they are identifiers of epistemic cultures.

Back row (from left to right): Nathan Sidoli, Janet Beery, Tom Archibald, Jackie Feke, Victor Katz and Paul Wolfson. Front row (from left to right): Laura Turner, Andrea Arredondo, Janet Barnett and Bruce Petrie

Deductive structure and mathematical tables in Ptolemy's *Almagest*

Nathan C. Sidoli, Waseda University, Tokyo, Japan

In this talk, I addressed a number of interesting features of the mathematical tables in Ptolemy's *Almagest*. I first discussed how they can be understood in terms of ideas related to mathematical functions, how they model geometric figures and allow a study of motion, and how they fit into the deductive framework of Ptolemy's approach. Finally, I made some remarks about the different function of tables in Ptolemy's *Handy Tables*.

Theory versus tables in second-millennium applied mathematics in India

Kim Plofker, Union College

Beginning at least as early as the first millennium BCE, Sanskrit technical texts on astronomical computation provided challenges and applications for the development of Indian mathematics as well as preserving records of it. Towards the middle of the second millennium, a significant part of Sanskrit mathematical astronomy shifted its focus and format from the traditional verse treatises and handbooks to a bewildering variety of table texts. This talk explored the impact of this shift on technical and pedagogical aspects of the subject, as user-friendly tables grew in popularity and ingenuity.

Elliptical Orbits and the Conflict over the Calculus

Paul R. Wolfson, West Chester University

In what has been called the central argument of the *Principia*, Isaac Newton derived the elliptical shape of the planets' orbits. In the years following its publication in 1687, however, this argument and other portions of the Principia received significant criticism from, among others, Johann Bernoulli. In this expository talk, I described Newton's argument, the criticism it received, and Newton's rebuttal, all of which suggest some of the substantial issues in the conflict between the Newtonian and Leibnizian forms of the calculus.

Your humble Servant, Is. Newton

William Dunham, Muhlenberg College

Half a century ago, Cambridge University Press began publishing the letters of Isaac Newton. Last summer, I read them all. In this talk, I shared my favorite examples of Newton as correspondent. From his first known letter (where he scolded a friend for being drunk), through exchanges with Leibniz, Locke, et al., and up to documents from the period when he ran the Mint in London, these writings give glimpses of Newton at his best ... and worst. I ended with Newton's most-quoted line and how my search for the original led me, improbably, to a smallish library in Philadelphia.

A Reader's Guide to the Classification of Quadratic Forms in the *Disquisitiones Arithmeticae*

Lawrence A. D'Antonio, Ramapo College of New Jersey

Gauss, in his *Disquisitiones Arithmeticae*, develops a rich, but confusing classification of quadratic forms. There are classes, orders, and genera of forms. This talk explained this classification scheme using Gauss's own examples, ending with the statement of the Gauss class number conjectures.

The Reverend Thomas Hill (1818-1891): Educator, Administrator and Mathematician

Eisso J. Atzema, University of Maine

Nowadays, Thomas Hill (1818-1891) is perhaps best known as the immediate predecessor of Charles Elliot as president of Harvard College, a position which he held from 1862 to 1868. He also was president of tiny Antioch College for the two years preceding his tenure at Harvard, having succeeded Horace Mann as its first president. Before that, Hill was mostly known as a prominent Unitarian minister, an educator and a promising mathematician. In this talk I discussed the nature of his mathematical writings and how this work relates to Hill's other writings. In addition, I discussed the influence of his teacher Benjamin Peirce. Focus was on Hill's two published geometry textbooks as well as their unpublished sequel.

Promoting mathematics in the Greco-Roman world

Jacqueline Feke, University of Chicago

This paper explored how and in what context Greco-Roman mathematicians promoted the study of high-level mathematics. I examined two case studies: Hero of Alexandria, the first-century mechanician, and Claudius Ptolemy, the second-century mathematician. Hero and Ptolemy justified their choice to devote their leisure time to mathematics in the introductory chapters of Hero's *Belopoeica* (his text on artillery construction), as well as his *Pneumatica*, *Metrica*, and Ptolemy's *Almagest*. I argued that Hero and Ptolemy were not only justifying their choice to study high-level mathematics in these passages but that they were also promoting it in the hope that would-be philosophers would instead become mathematicians.

Weyl's lecture courses on group theory at the Institute for Advanced Study (Princeton) before the Second World War

Christophe Eckes, Institut de Mathématiques de Toulouse, France

In this talk, we aimed at analyzing Weyl's lecture courses on the theory of Lie groups (1934-1935) and on invariant theory (1935-1937) at the IAS. In particular, his lectures on invariant theory led to his famous book entitled *The Classical Groups, their Invariants and Representations* (1st edition 1939, 2nd edition 1946). To this end, we commented on two kinds of documents which can be found at the Weyl archive (ETH-Bibliothek): 1. a series of notebooks, in which Weyl sketches the main outlines of his courses; 2. the typescript fascicules of these lectures written by Weyl with the help of his assistants: R. Brauer, O. Blumenthal and A. Clifford. We also tried to determine the audience of his courses and described Weyl's situation at the Institute for the Advanced Study before the Second World War.

Biogeometry, 1941

Marjorie Senechal, Smith College

Twelve years before the discovery of the double helix, Smith, Amherst, and Mount Holyoke Colleges made a joint appointment – their first – to jump-start a brand new field. The field was "molecular biology," a phrase then-recently coined; the appointee was a controversial British mathematician, Dorothy Wrinch. Why a mathematician, and what was the controversy? In this presentation, I show how the course she gave illuminates a fierce debate over the roles of geometry and symmetry in the biological sciences.

Creating a Life: Emil Artin in America

Della Dumbaugh, University of Richmond, and Joachim Schwermer, University of Vienna

In their preface to *The Collected Papers of Emil Artin*, Serge Lang and John Tate offer a succinct account of Artin's time in America. "He spent one year at the University of Notre Dame," they summarize, "then was at Indiana University in Bloomington from 1938 to 1946, at which time he moved to Princeton, where he stayed from 1946 to 1958. He retu.rned to Hamburg in 1958." Artin died at the age of 64 on December 20, 1962. On this occasion near the fiftieth anniversary of Artin's death, this talk provided further insight into the years Artin spent in America and some of his contributions.

Back row (from left to right): Marjorie Senechal, Jackie Feke, Christophe Eckes, Nathan Sidoli, Della Dumbaugh, Eisso Atzema and Paul Wolfson. Front row (from left to right): Sandro Caparrini, Laura Turner, Fred Rickey and Bruce Petrie