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

Atlanta, Georgia (USA); January 4-5, 2017

By Sloan Despeaux and 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 in Atlanta, USA. The session was organized by Sloan Despeaux (Western Carolina University), Daniel Otero (Xavier University) and Adrian Rice (Randolph-Macon College), and featured 25 speakers from a total of five countries, including the United States. Once again, the sessions included three moderated panel discussions on themes arising from some of the talks. The themes this year were:

- How to write historical mathematics.
- The transmission and communication of mathematics across cultures.
- The influence of applications on mathematics and mathematicians in Britain in the 19th & 20th centuries.

The following speakers presented talks at the meeting:

From "Vir Celeberrime" to "Hochedelgebohner Herr": From Euler to Goldbach

V. Frederick Rickey, West Point, New York & Jordan Bell, University of Toronto, Canada

For 35 years Euler and Goldbach corresponded about many facets of mathematics: algebra, analysis, geometry, and, especially, number theory. They discussed theorems, conjectures, the status of their attempted proofs, as well as books, travel, family, and their contemporaries. A new edition of the correspondence in Euler's *Opera Omnia*, IVA.IV, 2014, edited by Franz Lemmermeyer and Martin Mattmüller, contains English translations of the letters, as well as a great deal of information about eighteenth-century mathematics. This presentation discussed some of the high points of this wonderful correspondence.

John Playfair's Approach to "the Practical Parts of the Mathematics"

Amy Ackerberg-Hastings, Rockville, Maryland

Best known for *Elements of Geometry* (1795) and *Illustrations of the Huttonian Theory of the Earth* (1802), University of Edinburgh mathematics and natural philosophy professor John Playfair (1748–1819) also wrote several dozen books, expository articles, and opinion pieces as individual publications or for the *Philosophical Transactions of the Royal Society of London*, *Transactions of the Royal Society of Edinburgh*, and the *Edinburgh Review*. Most of these works have been digitized and are readily available for study. In contrast, Playfair's 1793 *Prospectus of a Course of Lectures on Some of the Practical Parts of the Mathematics* has nearly disappeared, with as few as eight surviving copies. In this talk, I considered what we can learn from this document, which consists of a nineteen-page list of potential topics. Despite its brevity, the *Prospectus* includes a number of themes and priorities that recurred throughout Playfair's writing and teaching. It also suggests how Playfair understood the role of

mathematics with respect to the physical and natural sciences, and reminds us of his influence as an educator and cosmopolitan intellectual.

The Lay of the American Mathematical Landscape in the 1920s

Karen V. H. Parshall, University of Virginia

In the 1920s, American mathematicians returned to their pre-World War I research agendas with renewed vigor at the same time that they trained a next generation. This talk surveyed the lay of the American mathematical landscape during that decade by locating mathematicians within their varied institutional settings, by gauging their appetite for mathematical research, and by taking, as a case in point, American geometrical research.

Solomon Lefschetz: The Man, The Mathematics

Della Dumbaugh, University of Richmond

Solomon Lefschetz played a critical role in the American mathematical community in the early twentieth century. He contributed significantly to algebraic topology, its applications to algebraic geometry, and the theory of non-linear ordinary differential equations. He not only exhibited academic excellence in mathematics, but he also demonstrated leadership as a faculty member at the University of Princeton and as President of the American Mathematical Society. He also edited the *Annals of Mathematics* and revised American engineering education. Even with all of his contributions to mathematics and the broader community, Lefschetz is often described as a man with rather unpleasant characteristics. Yet, Lefschetz alone wrote the letter that would bring Emil Artin and his young family to America to escape the situation in Nazi Germany. This talk offered a richer understanding of Lefchetz the man and his work in mathematics.

Scientific Diplomacy & Identity: Richard Courant in the 20th Century

Brittany Shields, University of Pennsylvania

This paper explored the complicated, and sometimes conflicting, social roles of American mathematicians in the twentieth century. New York University's Courant Institute of Mathematical Sciences was taken as a focal point in which to review the lives and careers of its founding mathematicians, including Richard Courant, Kurt O. Friedrichs and James J. Stoker. Their involvement in a multitude of social roles – from the founding of the institute in the 1930s, through contractual military work during World War II, and then diplomatic efforts in the Cold War era – was considered. The paper asked how individuals, such as Courant, navigated the complicated terrain of twentieth-century scientific diplomacy, balancing both national and international demands, in times of both war and peace.

The Krieger-Nelson Prize Lectureship

Laura E. Turner, Monmouth University

The Krieger-Nelson Prize Lectureship honours outstanding research by women members of the Canadian mathematical community. First awarded in 1995, it is named after Cecilia Krieger (1894-1974), the first woman to earn a Ph.D. in mathematics from a Canadian university, and Evelyn Nelson (1943-1987), a prolific researcher in universal algebra. In this talk, we explored the origins and early history of this prize, from the contributions of its namesakes to the motivations behind the prize itself.

From L'Hôpital to Lagrange: Analysis Textbooks in the 18th Century

Robert E. Bradley, Adelphi University

We examined broad trends in the evolution of analysis in the 18th century, as reflected in textbooks, particularly those of de l'Hôpital, Euler and Lagrange.

Jean le Rond d'Alembert: l'enfant terrible of the French Enlightenment

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

The year 2017 sees the tercentenary of the birth of Jean d'Alembert, a mathematician and philosopher of undoubted achievement, but also a frequent combatant in disputes and controversies. In this talk we reviewed his mathematical career, including those disputes. We also examined his central role in the Enlightenment as a member of the Académie des Sciences and as co-editor of the *Encyclopédie*.

Did Euler Scoop Möbius?

William Dunham, Bryn Mawr College

The Möbius function is a fixture of number theory. It is usually traced to an 1831 paper by August Ferdinand Möbius where, somewhat surprisingly, it arose in an analytic, rather than a number theoretic, setting. But perhaps more surprisingly, the function can be spotted in Leonhard Euler's classic text, *Introductio in analysin infinitorum*, from 1748. In this talk, we examined Euler's clever reasoning that anticipated, by nearly a century, the work of Möbius (who, by the way, had both a front and a back).

The Power of Power Series: Hensel and Analogy

Fernando Q. Gouvea, Colby College

Hensel's creation and use of the p-adic numbers was motivated to a large extent by the analogy between number fields and function fields. This analogy led him to new ideas and results but also to at least one disastrous mistake. In this talk, we looked at both, leading us to think about the power and dangers of analogy in mathematics.

A Tour of Group Generalisations of the 1920s and 1930s

Christopher D. Hollings, University of Oxford, United Kingdom

The process of generalisation in mathematics sometimes gets a bad press owing to the presence in the literature of many an ill-motivated 'generalisation for generalisation's sake'. However, a number of different generalisations of the group concept emerged in the 1920s and 1930s, each designed to solve a particular problem. Although not all of these newly defined objects went on to receive broader study, they are nevertheless good examples of well-motivated generalisation. A survey of a selection of these was given, pointing out some of their interesting interconnections.

An incompleat chronology of the (7,3,1) block design

Ezra Brown, Virginia Tech

The (7,3,1) block design has appeared in many times and places, frequently disguised as something else. In this talk, we traced the chronology of (7,3,1) from its apparent beginnings in the mid-nineteenth century up to present time. We discussed difference sets, tournaments, finite geometries, normed algebras, Hadamard matrices, error-correcting codes, Venn diagrams, as well as what is meant by "apparent" beginnings.

How did Leibniz solve the catenary problem?

Michael R. Raugh, Los Angeles, California

In *Acta Eruditorum* of June 1691 Leibniz presented the first solution to the catenary problem as a classical straightedge-and-compass construction. Johann Bernoulli also presented a solution obtained by correctly formulating a differential equation derived from considerations of static equilibrium. Leibniz did not explain his derivation, and there are some oddities. His curve cannot be a catenary because *e* is not constructible. But he names features that can only be true for a catenary; a line segment equal to a specified arc and the tangent at a point. It is remarkable that his construction (with slight qualification) exhibits the catenary structured as a hyperbolic cosine, not then known by name or formulation. Another oddity: Bernoulli proved that Leibniz's construction was indeed a catenary! Did he not notice that it wasn't? For proof, he showed that the construction yields the same differential equation he had derived, but he began with a logarithmic curve correctly defined by a differential equation, thereby avoiding Leibniz's limitations of construction. This talk presented a simple solution obtained using methods that I believe were available to Leibniz. While I do not claim that he solved the problem in this way, I do think that paths like this were open to him.

Left to right: Michael Raugh, Christopher Hollings and Robert Bradley.

The Jullien Models of Descriptive Geometry

Amy Shell-Gellasch, Montgomery College

Descriptive geometry was developed by Gaspard Monge in the 18th century and quickly became an important part of the education of engineers and architects, as well as mathematicians. This area of geometry uses projections to exhibit the properties of three-dimensional objects on the plane. The

French mathematician A. Jullien wrote a popular text book on descriptive geometry in the 19th century. As an aide to learning, he also developed a set of thirty physical models to exhibit how the projections are made. A set of Jullien Models is among the Smithsonian National Museum of American History's collections. This talk explored these beautiful teaching models.

The Mathematical Department of the *Educational Times and Journal of the College of Preceptors*

J. J. Tattersall, Providence College

A number of significant mathematical journals have included a section devoted to mathematical problems intended to challenge and educate their readers. None has had a more extensive list of contributions and world-wide readership than the monthly periodical *The Educational Times and Journal of the College of Preceptors*. Between 1848 and 1918, there were more than eighteen thousand contributions to the mathematical department from amateur and professional mathematicians. Beginning in 1864, the columns devoted to mathematical problems and solutions was republished in six-month installments as *Mathematical Questions and Solutions from the Educational Times*. We discussed the data collected on contributors and their contributions, and described plans to put the information into an accessible database.

Almanack and Almanaque: the Calendrical Periodical in 17th-Century North America

Bruce S. Burdick, Roger Williams University

Originally, the primary content of an almanac was an ephemeris, a detailed calendar indicating the motions of the planets. Eclipses for the year, if any, needed to be predicted. Religious holidays and predictions of the weather were usually included. These items are still present in most modern almanacs but they no longer dominate. In the early centuries of printing, the owner of a press had an incentive to find an almanac author because almanacs were expected to sell out their print run. An almanac author needed to be either a good calculator or a good plagiarist. None of the printed almanacs from seventeenth-century Mexico are known to have survived, but we have manuscript copies of many of them among the Inquisition records at the Archivo General in Mexico City. The majority of the almanacs printed in the English colonies in the same century have survived in their published form, although they are all quite rare. In this talk we looked at the almanac traditions in both of these areas. By way of having a representative of each, we focused on the careers and writings of Carlos de Sigüenza y Góngora, who lived and published in Mexico City, and John Tulley of Saybrook, Connecticut, who wrote for presses in Boston.

The Early Teaching of Descriptive Geometry in the United States (1817–1915)

Thomas Preveraud, LML Université d'Artois/ESPE Lille Nord-de-France

In the United States, descriptive geometry was a subject very few mathematicians, teachers or engineers knew about before 1820. Most of them were self-taught, as it was not introduced in any curriculum before 1817. This communication presented the first course of descriptive geometry ever taught in the United States by French polytechnician Claude Crozet, professor of civil engineering at West Point between 1817 and 1823, who introduced the subject to the West Point curriculum in 1817. Descriptive geometry soon became a subject taught in colleges, especially in those that had already started to offer their students elective courses, or special engineer-training programs. Thus, descriptive geometry went gradually from a restrictive-audience subject to a general-interest subject often presented as a sequel to the classical geometry course. Textbook authors introduced then new elementations of the method of projections in order to fit the changing readership and the changing

place of the subject in the various curricula. After 1875, the practical role played by descriptive geometry remained crucial in emerging technical institutions, where it once more found its original mission as a graphic art for the training of engineers.

Left to right: Bruce Burdick, Kim Plofker, Niccolò Guicciardini, Thomas Preveraud and Joseph Dauben.

Publishing mathematics in 18th-century Geneva and Lausanne

Niccolò Guicciardini, University of Bergamo, Italy

During the eighteenth century, several towns located in what is known today as Suisse romande were extremely receptive towards scientific culture. This paper focused on editorial enterprises taking place in Geneva and Lausanne that were important for the development of eighteenth-century mathematics.

An Indian version of al-**Kāshī**'s method of iterative approximation of sin1º

Kim Plofker, Union College

An ingenious technique attributed to the 15th-century astronomer-mathematician Jamshīd al-Kāshī for iteratively approximating the sine of 1º was adapted into a Sanskrit recension sometime in the early 18th century. This talk explored the adaptation process and some refinements in the Sanskrit version.

Rationales for Mathematics and its Significance in Recently-Excavated Bamboo Texts from Ancient China

Joseph W. Dauben, City University of New York

This presentation investigated the rationales given in prefaces to ancient mathematical texts about the reasons and rationales for doing mathematics, and what its significance was for masters and teachers alike according to recently excavated bamboo texts from ancient China.

Mathematicians as Consultants in Eighteenth-Century England

David R. Bellhouse, University of Western Ontario, Canada

In the 1730s the French art critic, Jean-Bernard Le Blanc, visited England and commented that compared to those on the Continent, English mathematicians received little if any financial support from the government. This continued to be the case throughout the eighteenth century. A few English mathematicians obtained positions at the universities. The rest typically earned their living through teaching in various schools and as private tutors. For example, in about 1750 James Dodson's salary for teaching at the Royal Mathematical School was 100 pounds per annum. Le Blanc estimated that in France someone like Abraham De Moivre would receive a pension of 1000 crowns per annum with minimal duties attached. Some of the English mathematicians supplemented their income by providing clients with valuations of life contingent contracts related to property. This talk explored the nature of this consulting activity and compared it to the author's own experience in statistical consulting over the past few years.

Mathematical Induction and Nature of British Miracles

Daniel S. Silver, University of South Alabama

The term "mathematical induction" is often attributed to Augustus De Morgan, who used it casually in an encyclopedia article of 1838. In fact, the term is older. We described how mathematical induction inspired Charles Babbage as he conceived his calculating engines.

Writing the mathematical biography of Ada Lovelace

Ursula Martin, University of Oxford, United Kingdom

Ada, Countess of Lovelace (1815–1852) is famous for a paper published in 1843, which presented Charles Babbage's unbuilt general-purpose computer, the Analytical Engine. A detailed description of the machine was accompanied by a table, displaying how it might compute the Bernoulli numbers, often called "the first computer programme". Lovelace has been celebrated in a number of biographies, which focus more on her famous father (the poet Lord Byron), her relationship with her mother, and her tragically short life, than her mathematical and scientific contribution.

Yet the archives include accounts of her early mathematical education, and a remarkable correspondence course undertaken with Augustus De Morgan when she was in her mid-20s, in which she studied advanced mathematics, and discussed research frontiers of the day, such as quaternions and divergent series. This correspondence allows us to reassess the knowledge that enabled Lovelace to write so articulately about Babbage's engines, and to undo the misapprehensions of biographers who have variously dismissed her mathematics as "hieroglyphics", or misunderstood the context of mathematics or of women's education. It also raises the broader question of how we misremember and misreport the achievements of female mathematicians.

"Knowledge gained by experience": Olaus Henrici—engineer, geometer and maker of mathematical models

June Barrow-Green, The Open University, United Kingdom

The (Danish-born) German mathematician Olaus Henrici (1840–1918) studied in Karlsruhe, Heidelberg and Berlin before making his career in London, first at University College and then, from 1884, at the newly formed Central Technical College where he established a Laboratory of Mechanics. Although Henrici's original training was as an engineer, he became known as a promoter of projective geometry. This talk explored connections between these two sides of Henrici's work.

The Perilous Practice of 'Flying and Applying'

Tony Royle, The Open University, United Kingdom

Early aeronautical research in Britain was advanced by a decision to allow a number of the nation's finest young mathematicians to train as pilots and conduct airborne experiments using full-scale aircraft. Given that many would subsequently perish in flying accidents, this talk assessed whether the risk was worth the reward.

Left to right: Tony Royle, Ursula Martin, June Barrow-Green, Daniel Silver and David Bellhouse.