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Mathematics Emerging: A Tribute to Jackie Stedall and Her Influence on the History of Mathematics

The Queen's College, Oxford, UK
Saturday 9 April and Sunday 10 April 2016

Organizers

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Financial Support was gratefully received from: The British Society for the History of Mathematics; The London Mathematical Society; The International Commission on the History of Mathematics; The Queen's College, University of Oxford; The Mathematical Institute, University of Oxford

The speakers offered talks that very clearly focused on sixteenth and seventeenth century (broadly interpreted) history of European (broadly interpreted) contributions to or developments in algebra, analysis and geometry (all broadly interpreted). Four of the twelve talks were of general interest; eight reported on exciting new research. One of those, in fact, interpreted both 'European' and 'sixteenth century' just as broadly as we had hoped. It was an exceptionally exciting and well-received account by Professor Eleanor Robson of archaeological findings, and her readings of clay tablets from the sixteenth century BC, that were less than a month old but promise to revolutionise our knowledge of both literacy and numeracy in southern Iraq. Although 12 talks in two days might sound a daunting programme, it had been possible to build in a good amount of discussion time, and there was indeed, a great deal of discussion.

In addition, there was a performance by the Queen's College Choir of music dedicated to the memory of Jackie Stedall, including a setting by Philip Cooke of some of her inspirational last words; there was an exhibition not only of her nine published books, but also of the four facsimiles of the Sixteenth Century mathematical writings of Robert Recorde made by Gordon Roberts (who gave a short talk on the project and the encouragement he had received from Dr Stedall) with the help of his wife Elizabeth; and there was a visit to the beautiful Upper Library of Queen's College, to view the contributions that Dr Stedall had made to the restoration and preservation of the college's valuable collection of historic mathematical texts, one of which is a very rare original copy, also exhibited, of Robert Recorde's *Whetstone of Witte*.

There were 54 participants at the conference, including 4 doctoral students.

MAIN SPEAKERS

Karen Hunger Parshall (University of Virginia, USA):
A Plurality of Algebras, 1200–1600: European Developments from Fibonacci to Clavius

As Jackie Stedall argued in her 2011 book *From Cardano's Great Art to Lagrange's Reflections: Filling a Gap in the History of Algebra*, there was a "transition from the traditional algebra of equation-solving in the sixteenth and seventeenth centuries to the emergence of 'modern' or 'abstract' algebra in the mid nineteenth century" (p. vii). This talk will trace the evolution from the thirteenth-century work of the Pisan mathematician, Leonardo Fibonacci, to the early seventeenth-

century work of the German Jesuit Christoph Clavius of what came to be considered "traditional algebra." It will argue that rather than a single "traditional algebra," in fact, a plurality of intimately related yet subtly different algebras emerged over the course of those four centuries in different yet interacting national settings.

Niccolò Guicciardini (University of Bergamo, Italy):
Isaac Newton, Historian of Mathematics

Isaac Newton was not only a first-magnitude 'geometer' and 'natural philosopher', but also an accomplished 'divine' and 'historian'. In his maturity (and maybe even earlier), he undertook an erudite study of the history of the early Church. Further, especially after his move to London in 1696, he displayed his double competences in astronomy and history as a writer on chronology. In recent years, great attention has been devoted to Newton as a scholar intent on bookish researches guided by humanistic expertise in the history of early civilizations and of pagan and Christian religions.

Newton did not write systematically on the historical development of mathematics, an interest that, to make a pertinent example, features in the work of his contemporary John Wallis. Moreover, in his mathematical works (with the exception of the mathematical entries of the youthful MS C.U.L. Add. 3996), Newton seldom employed humanistic hermeneutic techniques, such as common-placing and collation of excerpts; techniques that characterize his alchemical, religious and chronological writings. Nor did Newton devote himself to editions of Greek (and Arabic) mathematical works, as Isaac Barrow did in the 1650s, and later Wallis, Edward Bernard, David Gregory and Edmond Halley in Oxford, Robert Simson and Matthew Stewart in Scotland.

Thus, *prima facie*, little of Newton's scholarly expertise as a historian is discernible in his mathematical work. Three notable exceptions may elicit our interest in the context of my talk.

(i) Newton's manuscript writings on the lost works of the ancient geometers (such as Euclid and Apollonius) which were an inspiration for Gregory and Halley in their editions;

(ii) Newton's rumination on the ancient mathematicians (Pythagoras *in primis*) in the so-called Classical Scholia and in related writings devoted to the *prisca*;

(iii) Newton's textual and historical research regarding the polemic with Leibniz, when, in order to secure his priority in the invention of the calculus, he produced (in co-operation with acolytes such as John Keill and William Jones) a forensic account of an 'exchange of letters' mostly with Collins, Oldenburg, and Wallis concerning the 'birth of analysis' (the *Commercium epistolicum* (1713/1722)).

Benjamin Wardhaugh (All Souls College, Oxford):
Communicating with France. British mathematics in the period of Charles Hutton (1737–1823)

British mathematics in the second half of the eighteenth century is still frequently thought of in terms of an unflattering comparison with Paris and St Petersburg. The story is that British mathematicians failed to keep pace with self-evidently important developments taking place elsewhere. In some ways that story is the product of hindsight: unrealistic and unfair. Building on work by Niccolo Guicciardini and by Alex Craik, this talk will take a more optimistic – and realistic – view.

I will look at how British mathematics was organised and published, and how institutional and political factors constrained it. And I'll show how it throve in its own terms, remaining intellectually creative and producing mathematics and mathematicians which could be successfully exported to North America, British India, and even France, Germany and Russia. As a coda I will consider how

and why Britain, in its turn, imported mathematics (and mathematicians) from continental Europe. And I'll say something about how that eventually led to a sense of crisis in British mathematics in the first decades of the nineteenth century, and gave us the pessimistic view of Georgian mathematics that's still with us today.

Eleanor Robson (University College London):
Tabular material in newly discovered cuneiform tablets from the 16th century BC

For the past few years I have been fortunate to be the epigrapher on the first British excavation in southern Iraq since the start of the UN sanctions regime in 1990, which banned international research in the country. The Ur Regional Archaeology Project, headed by archeologists from the University of Manchester, is exploring a village occupied until the mid-second millennium BC a few miles from the famous ancient city of Ur. It is shedding important new light on a previously little-known period of history, about 150 years after the reign of famous king Hammurabi, thanks to an archive of cuneiform tablets which it is my task to decipher and interpret. Some of these objects are only now emerging from the ground; I make an annual trip to study the new discoveries each February. In this talk I will focus on two aspects of the finds which I think would have had particular interest for Jackie: the accounting practices in the archive, and the entirely unexpected evidence for formal scribal schooling, of a type hitherto found only in wealthy urban contexts.

Robert Goulding (University of Notre Dame, Indiana, USA):
Harriot's 1605 Colour Experiments

In April 1605, Harriot embarked on a series of optical experiments with triangular prisms: solid glass ones, and a triangular tank filled with water. By this point, he already had discovered the sine law of refraction; these experiments were intended to measure the differing constants of refraction associated with different colours. In this paper, I will describe Harriot's experimental procedure, and suggest how his experimental investigation of colours related to his theoretical understanding of colour (so far as that can be reconstructed). The manuscript papers recording the colour experiments are among the most complicated in the collection, in terms of their current disorder, and the interlocking relationships among the calculations, equations, and empirical data scattered across twenty-six or so pages. I will demonstrate how the Harriot Online project that Jackie began at the Max Planck Institute, helps to make sense of this web of documents.

Matthias Schemmel (Max-Planck-Institut für Wissenschaftsgeschichte, Berlin, Germany):
From forced to inertial motion: Thomas Harriot's integration of practical and theoretical knowledge on motion

Early modern mathematical mechanics faced the challenging task to cope with a spate of novel developments in technology. The practices of engineers and gunners not only motivated the study of one or the other object, they also brought about new empirical knowledge that had to be taken into account by any theory. The presentation focuses on the case of projectile motion in Thomas Harriot's working notes, which are a unique source for tracking the interaction between practical and theoretical knowledge, mediated by mathematical means of representation.

Thomas Sonar (Technische Universität Braunschweig, Germany):

… in the darkest night that is …: Briggs, Blundeville, Wright and the misconception of finding latitude

In his famous *De magnete* William Gilbert gave in 1600 a description of a graphical device to find latitude from the measurement of the magnetic inclination (dip). In 1602 Thomas Blundeville published the book *The Theoriques of the seuen Planets* in which not only a design specification of the device was attached but also a table from which latitude could be read off directly if the magnetic dip was known. The table was computed by Henry Briggs but no hint was given as to the mathematical details involved. This was presented in the second edition of Edward Wright's *Certaine Errors in Navigation* published in 1602. We present Gilbert's theory, the geometric construction of the graphical device, and the mathematics on which the Briggsian table is based.

The research reported here goes back to the year 2000 when Jacqueline Stedall helped me significantly in preparing my stay in Oxford during my sabbatical 2001.

Rosanna Cretney (University of Oxford):
'Nor any Number can confine us': The mathematical art of changes in early modern England

The art of changes, now commonly known as change-ringing, is a distinctively English practice which originated in the seventeenth century. It consists of ringing a set of tuned church bells not in tunes, but in permutations known as changes. The mathematical questions raised by change-ringing are now most easily answered using group theory, and most modern commentaries on the theory of change-ringing have relied heavily upon group-theoretic ideas. However, the language of group theory, invented in nineteenth-century France, was clearly not available to writers on change-ringing in seventeenth- and eighteenth-century England. Rather less attention has been paid to the mathematical knowledge that actually was possessed by early modern change-ringers and writers on change-ringing. In this talk I will consider the development of change-ringing in the context of early modern English mathematics and of the likely mathematical background of its practitioners.

Philip Beeley (University of Oxford):
'To the publicke advancement.' John Collins and the promotion of mathematical knowledge in Restoration England

Up to now the history of mathematics has considered the intelligencer and mathematical practitioner John Collins only tangentially and not as a figure in his own right. There have been no scholarly articles devoted to him, nor has his contribution to the development of the mathematical sciences in England in the second half of the seventeenth century been examined. It was to correct this historical oversight that Jackie Stedall and the speaker decided to undertake the task of producing the first complete edition of Collins's letters and to preface this edition with a biographical essay illuminating the different sides of a man who made the promotion of "mathematick learning" the focus of his life's work.

Revisiting some of the "high end" projects with which Collins was most closely associated, including the publication of Pell's Algebra, and his attempted publication of the Kinckhuysen translation, the talk will consider the success of his promotional efforts in the context of the Royal Society against the background of his broader aim of expanding mathematical knowledge into less elevated social milieus.

SHORTER CONTRIBUTIONS

Norman Biggs (London School of Economics):
More Seventeenth-Century Networks

In a contribution to the *Oxford Handbook of the History of Mathematics*, Jackie Stedall described how some of Thomas Harriot's mathematical ideas were disseminated after his death in 1621. The aim of this talk is to discuss some other mathematical networks from around the same time. Our story will centre on the lives of two men, John Reynolds and Thomas Aylesbury. Both of them were influential in the extended mathematical community that existed in England in the first half of the seventeenth century, although neither made any original contributions to mathematics. In passing, we shall catch a few glimpses of the murky world of politics and government under the Stuart kings.

Staffan Rodhe: (Uppsala University, Sweden):
On Goldbach's recently found booklet on series

Christian Goldbach is today most famous for his hypothesis on even numbers, but he had many other strings to his bow. In a Swedish textbook on geometry by Anders Gabriel Duhre (1721) Goldbach is honoured for his theory of infinite series. Duhre also remarks that in Stockholm, in 1719, Goldbach had published a thesis on the sums of certain series. Most of the thesis is also translated into Swedish in Duhre's book. Goldbach's printed booklet on series was rediscovered in 2009 – in fact for the second time. It is bound together with other contemporary Swedish scientific texts. My talk will give more on the history of the booklet and bring light to some parts of Goldbach's theory.

Maria-Rosa Esteve (Universitat Politècnica de Catalunya, Spain):
The influence of Mengoli's Mathematical Ideas

In the seventeenth century many changes occurred in the practice of mathematics. An essential change was the establishment of a symbolic language as a formal language in mathematics, so that the new language of symbols and techniques could be used in operations to obtain new results and procedures in several parts of mathematics.

Pietro Mengoli (1626/7–1686), pupil of Bonaventura Cavalieri, considered the utility of algebraic procedures essential for solving all kind of problems. Mengoli, following the algebraic research of Viète, constructed a geometry of species, *Geometriae Speciosae Elementa* (1659), which allowed him to use algebra in geometry in complementary ways to solve quadrature problems, and later to compute the quadrature of the circle in his *Circolo* (1672). Mengoli computed such integrals for natural and half-integer exponents and displayed the results in triangular tables, now known as the harmonic triangle.

Gottfried Wilhelm Leibniz (1646–1716) was interested in Mengoli's works in a letter to Oldenburg as early as 1673, and again later, in 1676. The aim of this communication is to analyze Leibniz's excerpts on Mengoli's *Circolo* in order to show Leibniz's mathematical interpretations and comments. These analyses provide evidence of the ways in which Mengoli's mathematical ideas about algebra and geometry could perhaps have inspired Leibniz in some aspects of his own arithmetic quadrature.