ICHM

Report on the ICHM Co-Sponsored 24th Novembertagung on the History of Mathematics

De Morgan House, London, UK; November 20–22, 2013

Rosanna Cretney & Mairi Walker (Open University)

The 2013 Novembertagung on the History of Mathematics had 18 participants, all doctoral students or post-doctoral researchers studying some aspect of the history of mathematics. 17 of the 18 junior participants gave short talks; names, institutional affiliations, and details of talks are given in the enclosed conference programme.

In addition to talks by junior participants, the meeting included an invited lecture by Dr June Barrow-Green (Open University), titled *Cambridge mathematicians' responses to the First World War*.

The conference social also had an academic flavour, as it consisted of a tour of the Royal Society's premises at Carlton House Terrace, and a special exhibition on the history of mathematics, curated by the Royal Society's librarians.

In addition to generous sponsorship from the ICHM, we were successful in securing funding from the Open University, the London Mathematical Society, and the British Society for the History of Mathematics. We used the ICHM grant to subsidise the cost of accommodation for junior participants. We were able to finalise the registration fee at £60 per participant (including conference attendance, accommodation for 4 nights, and all meals for 3 days). As we had planned, all participants paid for their own travel to, from, and within London.

Overall, we believe that the conference was a success and broadly achieved the goals we set out in our grant application. We look forward to the 2014 Novembertagung, which will be organised by Christophe Eckes of the Université de Lorraine (Nancy, France).

Invited Lecture

Dr June Barrow-Green (Open University)
Cambridge mathematicians' responses to the First World War

Cambridge mathematicians responded to the First World War in different ways. On the one hand, there were those who, for reasons of conscience, refused to take an active part in the War, and on the other hand, there were those who volunteered to work at establishments such as the Royal Aircraft Factory or the National Physical Laboratory, or who joined the Anti-Aircraft Experimental Section of the Ministry of Munitions. In this talk, I shall consider the war-time activities of both kinds of mathematician, and discuss the effect of the War on their careers as well as on mathematics itself.

Abstracts

Viktor Blåsjö (Universiteit Utrecht)

A critique of the Oxford consensus in the historiography of mathematics

The modern historiographical consensus —as embodied in two recent, field-defining OUP books— has it that old-fashioned internalist history is 'obsolete' and that 'the gains in historical understanding are incomparably greater' in the more 'historically sensitive' works of today. I maintain that this self-congratulatory attitude is ill-founded. I argue that the modern consensus is in fact demonstrably insensitive to numerous aspects of historical mathematical thought, and that the alleged superiority of modern historiographical standards ultimately rests on a dubious redefinition of the purpose of history rather than intrinsic merit.

Alberto Cogliati (Università degli studi di Milano)

On Jacobi's transformation theory of elliptic functions

The main interpretative challenge set by the *Fundamenta Nova Theoriae Functionum Ellipticarum* lies in Jacobi's transformation theory upon which the entire theoretical edifice of the treatise depends. Unfortunately, Jacobi did not convey any indication of how he attained his general formulae for rational transformations of elliptic functions. He limited himself to providing *a posteriori* verification of the validity of his claims. The aim of this talk is precisely to describe the heuristic path by which in 1827 Jacobi succeeded in finding these transformation formulae. The proposed historical reconstruction will hopefully shed new light upon the emergence in Jacobi's work of the inversion process of elliptic integrals of the first kind and thus of the elliptic function sinam *u* itself.

Sara Confalonieri (Université Paris VII)

The telling of the unattainable attempt to avoid the casus irreducibilis *for cubic equations: Cardano's* De regula aliza

Solving cubic equations by a formula that involves only the elementary operations of sum, product, and exponentiation of the coefficients is one of the greatest results in 16th-century mathematics. This was achieved in Girolamo Cardano's *Ars magna* in 1545.

Still, a deep, substantial difference between the quadratic and the cubic formula exists: while the quadratic formula only involves imaginary numbers when all the solutions are imaginary too, it may happen that the cubic formula contains imaginary numbers, even when the three solutions are actually all real (and different).

This means that a scholar of the time could stumble upon numerical cubic equations of which he already knew three (real) solutions and the cubic formula of which actually contains square roots of negative numbers.

This will be lately called the *casus irreducibilis*. Cardano's *De regula aliza* (Basel, 1570) is (at least, partially) meant to try to overcome the problem entailed by it. Its (partial) analysis was the heart of my doctoral dissertation.

Rosie Cretney (Open University)
Euler and the mathematics of ship-building

In my PhD thesis, I plan to explore the place of correspondence and letter-writing in the mathematical practice of Leonhard Euler (1707–1783), with particular reference to letters relating to Euler's publications on naval science. These include correspondences with fellow theorists (including Clairaut, Bouguer, and Daniel Bernoulli) as well as with sailors and administrators. In my talk I will give a brief introduction to some of Euler's contributions in this area.

Simon Decaens (Université Paris VII)
Universal algebra: a historical approach (1935–1973)

Between 1945 and 1970 universal algebra quickly became a discipline with its own cursus, textbooks and the journal *Algebra Universalis*. In his book *Universal Algebra*, published in 1965, Paul Cohn portrayed a theory very similar to Abstract Algebra, though with a more general perspective. My master's thesis aimed to describe succinctly its emergence focusing on Garrett Birkhoff's publications in the thirties. Undoubtedly influenced by Emmy Noether's works, Universal algebra borrowed from English and American mathematicians their interest for logical theories (e.g. Boolean algebras). Among them was Alfred Whitehead, who published in 1898 a treatise in which he intended to legitimise the development of a mathematical practice freed from numbers and distances. At the junction of these traditions, Birkhoff developed a lattice theory along the line of Bartel van der Waerden's *Moderne Algebra*. In the process he required an entity encompassing both the classical structures of modern algebra and lattices, creating the concept of abstract algebras as a result. This episode of the history of modern algebra, in which two traditions of mathematical practice seems to merge together, qualifies Leo Corry's account of a straightforward circulation of the ideas contained in a treatise. A work consisting of a local contextualisation of the reception of structuralism in the United States appears therefore necessary.

Samson Duran (Université Paris Sud XI)
American geometries around the American Mathematical Society: 1888–1920

The 19th century saw the birth of a new practice in pure mathematics in the United States. Many of the U.S. national actors worked for the establishment of academic research in pure mathematics, often using European models as an inspiration. In 1888, the American Mathematical Society was created and has remained a very important organization in the development and dissemination of research in the United States. While present studies focus on algebra, analysis and arithmetic, in my PhD thesis I aim to explore the geometry as it was done by the actors associated with this institution. It is well known that knowledge had been circulating through two main ways: one between England and the United States because of the common language and the import of great mathematician J. J. Sylvester, and the other between Germany and the United States with an almost mandatory training in Germany for advanced American students. Through the study of the circulation of knowledge between Europe and the United States, I will try to show how the United States of America could be the place of hybridization between the geometric calculus and works inherited from Erlangen Program.

Christophe Eckes (Université de Lorraine)
Weyl's lecture courses on Lie groups and Lie algebras at the Institute for Advanced Study (Princeton) 1934–1935

In this talk, we aim at analyzing Weyl's lecture courses on the theory of Lie groups (1934–1935) at the IAS. To this end, we will comment 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: N. Jacobson and R. Brauer. We will try to determine the audience of his courses and we will describe Weyl's situation at the Institute for the Advanced Study before the Second World War.

Philipp Kranz (Bergische Universität Wuppertal)
Appointment policy in mathematics departments during the Nazi regime —sources, questions problems

In my paper, I will present some basic problems that arise in analyzing the policies of universities and state authorities in refilling vacant mathematical professorships in the Nazi period. The complexity of appointment processes will be investigated in two ways: by a comparative analysis of several universities and federal states and by case studies of some important appointments. The main (archival) sources are official documents from authorities (state and universities) as well as personal letters of mathematicians (Nachlässe). By presenting some typical cases and sources I will demonstrate the main questions and problems of my research.

Desirée Kröger (Bergische Universität Wuppertal)
Abraham Gotthelf Kästner and his Mathematische Anfangsgründe *—Didactic features*

The 18th century is also known as the 'educational century'. Before the 18th century the main teaching method was rote memorization. This changed in the context of the Enlightenment when discrete thinking became the principal educational goal and people began thinking about suitable teaching. The Göttingen professor and mathematician Abraham Gotthelf Kästner (1719–1800) commented on the way of teaching mathematics. He became known as a textbook author whose ten-volume *Mathematische Anfangsgründe* was one of the most frequently used textbooks at German universities, and contains all of the disciplines which were under the umbrella of mathematics at this time.

In my talk I would like to answer two questions:
1. In which way Kästner wrote about the way of teaching mathematics and didactic elements?
2. Which didactic features can be found in the *Mathematische Anfangsgründe*?

This might also be a contribution to the questions why Kästner was named as 'teacher of mathematics in Germany' and why his *Anfangsgründe* were so popular.

François Lê (Université Paris VI)
How to describe what remains tacit in mathematics: an attempt with the example of the 'geometrical equations'

In a particular chapter of his *Traité des substitutions et des équations algébriques*, Camille Jordan deals with what he calls 'geometrical equations', presented as particular equations arising from geometry. Such equations are mentioned in other texts, like Felix Klein's first paper on algebraic equations, where the geometrical equations are praised because they are intuitive examples in equation theory. In fact, a whole

section of the chapter on Galois' theory of the *Encyklopädie der mathematischen Wissenschaften* is devoted to the geometrical equations. Yet, neither in this section nor in the corpus that can be constructed from it can we find a precise definition of these equations, whereas a tacit understanding of them seems to be shared by many mathematicians.

Of course, our mathematical skills allow us to share this tacit understanding after reading the whole corpus. But an interesting job for the historian would be to find a way to describe it without having to mobilize a supposed mathematical instinct of the reader. Precisely, the aim of the talk is to present a methodology to quantitatively describe the geometrical equations. This methodology, inspired by picture analysis, will be used to reveal some characteristic features of the geometrical equations but also to describe the manifestations of the intuition evoked by Klein.

Isabelle Lémonon (Centre Alexandre Koyré)
A gender analysis around an eclipse in the 18th century in France: an appropriate question?

Through this talk, I would like to raise the difficulties one can face while working with gender in history of science. As an example, I will use the case of two essays about the eclipse of 1764, the first one written by Madame Lepaute, and the second one by Monsieur Le Carlier d'Epuisart, during the 18th century in France. What can we learn from the comparison of these two essays? What are the limits of this comparison? Is a gender analysis appropriate to this comparison?

Aurélie Mabille (UniversitéParis Sud)
What is mathematics useful for? Discourses about the reform of mathematics education in 1950s France

During the 1950s, within the context of mathematics education reform projects, places such as the Organization of European Economic Co-operation (O.E.E.C.) symposiums, popularization magazines or treatises' forewords were used to discuss mathematical needs of some fields which could use them in their practices. It is worth noting that the actors who took part in the mathematics education reform movement came from a wide range of backgrounds and specialities. Academic mathematicians, engineers, physicists, teachers, politicians were among them, as well as chemists, or social sciences specialists. It shows that mathematics education was the subject of varying expectations, among which the hope of fruitful reuse of mathematical tools in some expanding fields. Thus, discourses offer a new way to move forward our comprehension of the post-World War II attempts to reform mathematics education. It brings a new perspective on the 'mathématiques modernes' period. This moment is often seen as being a reinforcement of abstraction, rooted in the axiomatic movement, and carried out by a renewed algebra. Considering such fields as cybernetics, numerical calculus, statistics, atomic energy, and so on, leads us to consider the multi-faceted nature of the 'mathématiques modernes' and to underline the many links between them and concrete knowledge for direct utilization of mathematics for many different purposes.

Thomas Morel (Technische Universität Berlin)
Mathematics in the mines: a biographical sketch of the Markscheider J. A. Scheidhauer (1718–1784)

How was mathematics used in mining facilities during the eighteenth century? Which people possessed mathematical knowledge and how was it taught? Which kinds of interactions could exist between the daily practice of the engineers and theoretical considerations? Not much is known about the actual

use of mathematical sciences in the mines at that time. The example of J. A. Scheidhauer, a *Bergmeister* self-taught in mathematics, gives an insight into the role and content of this discipline before the creation of mining academies, and its relation to the more general *Bergbaukunde* (mining sciences).

Dagmar Mrozik (Bergische Universität Wuppertal)
Approaches to frontispieces in Jesuit mathematical writings

In this talk, I shall give an overview of my current research into the frontispieces of Jesuit mathematical writings in the early modern period.

A common definition of a frontispiece describes it as a decorative illustration usually preceding a book's title page, popular mostly in the 17th and 18th centuries. And while such an illustration is certainly very nice to look at, it fulfils many more functions than just being a decorative piece of art. It could, for example, show us the contents of the book at hand, maybe even summing up its main points in a graphical way; it could refer to the patron who helped pay for the printing and distribution by including his coat of arms or his portrait, thus telling us more about how the book came to be; or it could illustrate the relationships that the topic covered in the book has to other subjects, subjects that we, perhaps, might find to be disconnected or even contradictory.

With these three possibilities I am merely hinting at actual examples that can be found when studying the frontispieces of Jesuit mathematical writings from the early modern period. In my talk, I would like to present said examples, among others, to illustrate the many functions of those Jesuit mathematical frontispieces and thus the many approaches one can take in their investigation, as well as the problems that I am facing while working with them.

Nicola Oswald (Universtät Würzburg)
Detours to a PhD thesis

In July 1895, 37-year-old Julius Hurwitz (1857–1919), son of a Jewish merchant in Hildeshaim near Göttingen, was awarded a doctorate in mathematics. During his childhood his teacher, the famous geometer Hermann Caesar Hannibal Schubert (1848–1911), attested to Julius's extraordinary talent; however, he had to spend several years in various professions before he found his way to obtain a scientific degree.

Hurwitz's multifaceted life and his almost forgotten research results on complex continued fractions testify how social background and support were crucial for climbing the academic career ladder. On the basis of documents rediscovered in archives of ETH Zurich and the University of Göttingen we take a closer look on the obstacles the elder brother of the famous number theorist Adolf Hurwitz (1859–1919) had to overcome. Furthermore, we outline how he could finally succeed in scientific and social integration.

Eleonora Sammarchi (UniversitéParis VII)
The arithmetics of unknowns: how to operate in algebra in the 13th century

After the foundation of a theory of second degree equations, a group of Arabic mathematicians starts to conceive a coherent and exhaustive system of rules for calculating with algebraic entities. The aim is to become able to manipulate unknown quantities as the arithmetician manipulates the known ones. Among the mathematicians of this tradition, two names must be mentioned: al-Karajī (XI cent) and al-Samaw'al

(XII cent). In the XIII century al-Zanjanī follows this same tradition and his *Book of algebra* accurately recalls and elaborates on al-Karajī's work.

A short comparison of the three mathematicians' approaches to the problem of finding general rules and general applications of these rules will be followed by the reading of some extracts of al-Zanjanī's treatise concerning elementary arithmetical operations on unknown quantities. The description of such operations as subtraction, division and extraction of square roots are in fact extremely interesting for understanding the origins of polynomial algebra and they constitute the context in which al-Zanjanī, and before him Karajī and Samaw'al, confront problematic notions, for instance negative quantities.

Emil Simeonov (Fachhochschule Technikum Wien)
The Encyclopedia of Living Mathematics

In this talk I am going to present my thesis project: the first version of a work in progress which shall address the human factor in mathematics. These parts of mathematics where the human factor is indispensable I call altogether 'living mathematics' in contrast to 'dead mathematics' which consists of all the written texts and all their 'content' taken 'independently' from its authors and its readers (Popper's 'third world'). The encyclopedia in its first version contains approximately 80 entries, each of different length and not in a unified style. The individual entries try either to pose some questions or to present some methods for dealing with certain philosophical questions, or they just present arguments for the importance of the specific issue. Some of the entries have been addressed by others, mainly in the context of the philosophy of mathematical practice, but by far not all of them. Many of the entries contain testimonials by mathematicians of high reputation. Here are some examples of entries (of course in alphabetical order): agreement, ambiguity, audience, authority, commitment, concreteness, definitions, demonstration, evidence, experience, forgetting, games, habits, items, judgement, knowledge, limitations, memory, mistakes, notations, observation, passion, precedence, presence, profession, reconstruction, representation, self-reference, scrutiny, technique, time, training, unity, vague ideas, visualisation, …

The main intended audience is mathematicians in the broadest sense of the word. The encyclopedia is intended as a tool for reflection, containing both relevant questions and topics as well as methods to approach them. It might provide historians of mathematics with some useful questions. In the talk I will try to give an overview and to explain my motives and my aims.

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