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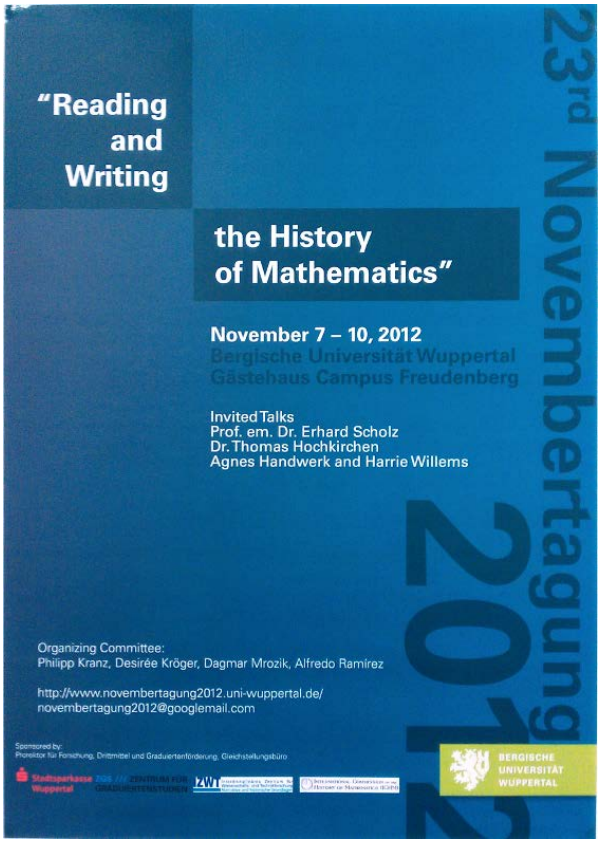
Report on the ICHM Co-Sponsored 23rd Novembertagung on the History of Mathematics *Reading and Writing the History of Mathematics*

Bergische Universität Wuppertal; November 07–10, 2012



The Novembertagung on the History of Mathematics is an international and interdisciplinary conference for junior researchers in the field of history of mathematics and, as such, has become an important date in the academic year since its inauguration in 1990. In 2012, the Novembertagung returned to its roots, taking place at the Bergische Universität Wuppertal where it had started 23 years ago.

Under the organization of local junior researchers Philipp Kranz, Desirée Kröger, Dagmar Mrozik, and Alfredo Ramírez, 21 participants from Germany, France, the United Kingdom, Canada, the Czech Republic, and the Netherlands gathered in Wuppertal to discuss current and future projects during the four day conference. Starting on Wednesday with a welcome session and introduction, all days – except for Saturday – were structured in the same way. The mornings and afternoons were reserved for the participants' talks, including time for discussion, and there was a lunch break around noon which was spent at the university canteen. The afternoon sessions were then rounded off with an invited talk, one each day, allowing a look into the workings of the history of mathematics on various levels:

- On Wednesday, Thomas Hochkirchen spoke about the successful career path he took outside of academic life in the industry, after having finished his PhD in the history of statistics.

- The next day, Thursday, the participants watched a documentary about the Russian mathematician Yuri Manin, presented by its makers, the journalists Agnes Handwerk and Harrie Willems. It sparked interesting discussions both about the movie itself and its subject.

- And on Friday, recently retired professor of history of mathematics Erhard Scholz spoke about epicycles in Greek astronomy, proving that even after a long working life with many interests and many projects, there were still things that fascinated him and that were also fascinating to others.

During this official part of the program, the conference was also attended by a range of visitors from the university itself. Professors, other PhD students, as well as students themselves came to hear selected talks.

In the evenings, the participants went out to enjoy dinner at various locations within the city and relax. There was also a self-organized guided tour on Friday.

Saturday, the last day, was used for a final evaluation. After giving valuable advice for the current (and future) organizers of the Novembertagung, the topic for the next conference in November 2013 was discussed, or rather the sense of choosing such a topic at all. The participants agreed unanimously that putting the Novembertagung under a certain theme might discourage beginning PhD students from attending since their own topic might not suit the theme, and that it was restricting the intended open focus of the conference. After all, the absolute aim of the Novembertagung is to give junior researchers the opportunity to bring up any interests or problems related to their work and discuss them with their peers. In the end, no real theme has been chosen for the next conference; however, it has been decided that it will be organized by Rosanna Cretney and Mairi Walker, both from The Open University.

The expenses for the 23rd Novembertagung on the History of Mathematics were met by

- International Commission on the History of Mathematics (ICHM),
- Interdisziplinäres Zentrum für Wissenschafts- und Technikforschung (IZWT) at the Bergische Universität Wuppertal,
- Zentrum für Graduiertenstudien (ZGS) at the Bergische Universität Wuppertal,
- Stadtsparkasse Wuppertal,
- Gleichstellungsbüro at the Bergische Universität Wuppertal, and
- the Prorektor für Forschung, Drittmittel und Graduiertenförderung at the Bergische Universität Wuppertal.

The ICHM's financial support was used to fund lodging for the participants and was thus vital in keeping the conference without a conference fee, something that otherwise might have been a problem for some attendees.

Participants of the 23rd Novembertagung, Wuppertal, 2012.

The following talks were presented:

VIKTOR BLÅSJÖ:

SHALL I COMPARE THEE TO A PARABOLA'S ARC? TRANSCENDENTAL CURVES IN THE 17TH CENTURY

Transcendental curves were the focal point of a profound conflict in late 17th century mathematics. They were at the heart of remarkable advances in the new fields of infinitesimal calculus and mathematical mechanics, but they also rendered obsolete traditional conceptions of geometrical rigour and method, forcing the boundaries of mathematics as defined by classical Greek and Cartesian geometry to be redrawn. This tension between the old and the new was profoundly felt by the pioneers of the new mathematics such as Leibniz, Huygens, and Jacob and Johann Bernoulli. Vigorous discussions on the proper means of representing transcendental curves were commonplace in the late 17th century, with a variety of mechanical and geometrical constructions being preferred to the modern analytic approach.

JENNY BOUCARD:

READING AND WRITING ABOUT CAUCHY'S NUMBER THEORY

Augustin-Louis Cauchy published most of his arithmetical research between 1829 and 1840. These are however only mentioned in some number theory history centered on reciprocity laws or on theory of algebraic numbers. They are described as containing some results similar to those of Gauss, Jacobi and Dirichlet but in an incomplete and disorganized way. In this talk, we propose a different reading of the arithmetical work of Cauchy by showing that they form a coherent whole, but obey a different perspective from that described in the literature cited above.

ROSANNA CRETNEY:

READING AND WRITING DIGITAL HISTORIES OF MATHEMATICS

The technological advances of the past twenty years have drastically altered the ways in which we read and write history. The availability of digital tools and methods such as databases, data visualisations, and text mining allow historians to delve into large datasets in new and innovative ways, and to build interactive and nonlinear histories that would previously have been unthinkable. In my talk, I will present a database and data visualisation web app that I have begun to develop as part of my PhD research on Leonhard Euler's correspondence. I will conclude with an exploration of some of the possibilities and difficulties raised by digital methods, with a particular focus on issues specific to the history of mathematics.

FARIBA ELLIEE:

HOW TO READ SOME OF THE CONCEPTS OF DIFFERENTIAL GEOMETRY AT THE BEGINNING OF THE 20TH CENTURY?

By the beginning of the 20th Century, E. Cartan classified some geometric structures such as: Riemannian, complex, systems of differential equations up to local or global change of coordinates to find normal forms for geometric structures and local invariants for such structures. Indeed, Cartan developed some powerful methods by employing differential forms and moving frames to attack some problems in differential geometry.

M. Hashtroudi, who was one of prodigy and arguably modern Iran's most eminent mathematician of his generation, associated a (cartanian) normal projective connection to any such system and computed the curvature of his connection. The terms Hashtroudi connection and Hashtroudi

curvature seem to be taking roots and still today after more than 70 years. Hashtroudi's connection was transplanted some 37 years later in 1975 by Chern and Chern-Moser into complex and CR-geometry.

I would briefly introduce a few conceptions in this geometry.

EVA KAUFHOLZ-SOLDAT:

A DIVERGENCE OF LIVES – CONTEMPORARY AND MODERN PORTRAYALS OF SOFJA KOWALEWSKAJA (1850–1891)

The historian B.J.T. Dobbs once compared the famous Isaac Newton to a Rorschach inkblot test: "What we already have in our psyches and intellects we tend to find in Newton." The same is true for Sofja Kowalewskaja. As the first woman to obtain her Ph.D. in Mathematics in Germany, she has fascinated historians, scientists and the general public alike. Already a controversial figure during her lifetime, Kowalewskaja became a prominent example for both promoters and opponents in the discussions about female intelligence at the turn of the century. Hereby, the debaters' arguments relied on the many biographical studies published shortly after her unexpected death in 1891, most of which claimed to present the "true Kowalewskaja".

Those diverging portrayals also influenced the modern historiography of the multifaceted woman.

My talk aims to present some of the various images of Kowalewskaja created by friends, colleagues and complete strangers, as well as the historical context in which they arose.

PHILIPP KRANZ:

HOW TO BE APPOINTED TO A PROFESSORSHIP OF MATHEMATICS IN THE NAZI ERA?

In the 19th century, university mathematics in Germany was characterized by an increasing number of Jewish scientists. They occasionally held about 20% of the full professorships in the 1920s. This radically changed after Hitlers Machtübernahme (seizure to power) in January 1933. Between 1933 and 1935, Jewish as well as politically disliked mathematicians were removed from office and many of them emigrated. In addition, mathematical professorships became ordinarily vacant in the Nazi era because of age or death.

In this paper, I analyse the process of filling the vacancies after the expulsion or retirement of the former professor by presenting some examples and general considerations.

DESIRÉE KRÖGER:

ABRAHAM GOTTHELF KÄSTNER AND HIS MATHEMATISCHE ANFANGSGRüNDE

The so called Anfangsgründe are scientific, introductory textbooks from the 18th century. They were created to assist teaching mathematics at German universities, and also for the use by students at any level. They contain all subjects which stood under the umbrella of mathematics at this time. So there are not only pure, but also applied mathematics, e.g. mechanics, statics, and optics. Very important is that these textbooks were written in German. Actually the typical language within the scientific community was Latin, but not everybody could read and write Latin. By using the German language other people could learn mathematics, also those who were not allowed to study, e.g. women. Therefore the Anfangsgründe could also be used for autodidactic studies.

A handful of popular Anfangsgründe-authors are known; one of them is Abraham Gotthelf Kästner (1719-1800), professor of mathematics and physics at the University of Göttingen. He published his Mathematische Anfangsgründe since 1758, which were leading in the second half of the 18th century.

My research is divided into two parts. First I will give a characterization of the Anfangsgründe as specific type of literature. Second I will look at Kästner as an influential textbook-writer and show up his merits within the Anfangsgründe-tradition. For this purpose the following main research questions should guide me: Why did Kästner see the need for a new textbook? What was actually new in them? What influenced Kästner?

FRANÇOIS LÊ:

JORDAN, GEISER AND THE 27 LINES: A SPECIAL STATUS OF THE THEORY OF SUBSTITUTIONS (1869-1870)

In his great Traité des substitutions et des équations algébriques (1870), Camille Jordan devoted a chapter to the "equations of geometry", among which the equation of the 27 lines upon the cubic surface. Using his substitutions techniques, he managed to prove a connection between the 27 lines and other special geometric configurations. On the other hand, but not independently, Carl Friedrich Geiser proved similar connections with geometrical techniques.

The aim of the talk is to highlight a special status of the theory of substitutions through a close reading of Jordan and Geiser's texts. More specifically, the maths will be compared to a very particular vocabulary in the comments of Jordan and Geiser. The result will be a rethink of the association "group theory/geometry", to which the present days used us to consider as natural.

ISABELLE LÉMONON WAXIN:

WOMEN' CONTRIBUTIONS TO MATHEMATICS IN THE 18TH CENTURY: A GENDERED QUESTION?

As is well known, 18th century in France saw the multiplication of "salons" which were led by women and where mathematics or science could be discussed as well as literature. These well-known women usually got together the brightest male minds of the time and were not really involved in the process of building or using mathematics and science. Yet, some lesser known women really took part in the process of developing the mathematical sciences. I will present some of their contributions and try to analyze their work in terms of calculations, modeling or teaching and communicating. The comparison of their personal trajectories, and of their social networks, will raise the question of the access of women to education and knowledge at this period, as opposed to male education. I will also take into consideration the social image of the *woman of science* in the 18th century to better understand the lack of primary sources which introduces a bias in my study.

JEMMA LORENAT:

A GEOMETRY BY ANY OTHER NAME: THE USE OF SYNTHETIC TO DESCRIBE GEOMETRICAL METHODS DURING THE EARLY NINETEENTH CENTURY

"The distinction between modern synthesis and modern analytic geometry must no longer be regarded as essential, inasmuch as both subject-matter and methods of reasoning have gradually taken a similar form in both," said Felix Klein in the 1893 English translation of his Erlangen Programme. Klein was not alone in defining a methodological divide between geometers of the beginning of the nineteenth century. Historical surveys such as Michel Chasles' Historique sur l'Origine et le Développement des Méthodes en Géométrie (1875), Gino Fano's Gegensatz von synthetischer und analytischer Geometrie in seiner historischen Entwicklung im XIX. Jahrhundert (1907), and Ernst Kötter, Die Entwickelung der synthetischen Geometrie von Monge bis auf Staudt (1847) (1901) split their predecessors into analysts and synthesists. Analytic geometry is consistently defined by its practitioners as employing a coordinate system, and occasionally in opposition to

synthetic geometry. But although later histories framed the debate as between two opposing practices, the authors and texts reveal many more geometries. Analytic geometry also contended with pure geometry, elementary geometry, ancient geometry, and even geometry properly speaking. By considering the context of specific citations, this presentation begins to parse the specific meaning of synthetic geometry during the first third of the nineteenth century.

AURÉLIE MABILLE:

BEYOND WRITING AND READING: THE DISCOURSES OF MATHEMATICIANS IN THE 1950'S IN FRANCE

What did mathematicians say about "modernity" in their field? How did they transfer this in education programs? The study of mathematicians' discourses allows bringing to the foreground their conceptions about their social roles.

The period I study, from the end of the Second World War to the beginning of the sixty's precedes the movement of reforms of the 1960's in France, called *réformes des mathématiques modernes*. During this period, actors of the field mobilized at an international scale for the renovation of the mathematical education.

The political need of building a uniform scholar body that provides a sufficient number of children with mathematical skills, able to pursue any scientist formations, is an important part of the context. The focus is about the description and appropriation by mathematicians of the social demand.

The speeches are to be found in different documents that constitute my corpus of sources: journals, conference proceedings, prefaces, publications or books' preliminary remarks. It appears at the study of bibliographical notes that a vast network of *modern* treatises, books, or articles advocated *modern* methods and contents. A couple of groups emerge with different objectives and argumentations. The dominant discourses, represented by Bourbaki, tended to hide the variety of stands that mathematicians took during this period. Contrary to the philosophically marked definition of modernity we have received from this period, sources show a wide range of *modernities* referring to applications and linked with other sciences, structuralism, social transformations or psychopedagogical debates of the time.

DAGMAR MROZIK:

THE POLISH JESUIT MATHEMATICIAN ADAM ADAMANDY KOCHAŃSKI (1657–1700) AND THE PROBLEM OF READING ABOUT HIM

If you wanted to learn more about the beginnings and foundations of the Jesuits, a male catholic order founded in 1540, you'd be well-advised to read John O'Malley's *The First Jesuits* from 1993. It offers a great introduction into their life, spirituality, and ideology – and it's in English. If you then wanted to learn more about a certain Jesuit you just read about, you could try looking him up on Wikipedia (in English, even), or you could use the *Diccionário Histórico de la Compañía de Jesús*. Which, not very surprising concerning its title, is a fairly recent Spanish dictionary in four volumes.

But let's say the Jesuit you wanted to learn more about is not well-known enough to be either on Wikipedia nor in the *Diccionário*. In that case you would probably have to see if you can find him in the *Bibliothèque de la Compagnie de Jésus*, a behemoth bibliographic work in ten volumes from the 1890s. Oh, it's also in French.

Now let's say you read O'Malley, used the *Diccionário* and the *Bibliothèque*, also lovingly called the Sommervogel after Carlos Sommervogel, its Jesuit compiler, and you still want to know more. Let's even say that your person of interest is somebody called Adam Adamandy Kochański, a Polish

Jesuit mathematician from the 18th century that you can't read anything about unless – well, unless you can read Polish. Then what?

In this talk I would like to take a closer look at this problem and illustrate how much knowledge remains hidden away, if not even how much knowledge gets lost by being written down in an "unpopular" language.

ALFREDO RAMÍREZ:

READING AND WRITING THE HISTORY OF SYMPLECTIC GEOMETRY

Reading the history of symplectic geometry in textbooks or in the few historical articles that there are can be quite confusing. For example, some authors found a symplectic form in Lagrange's Mécanique analytique from 1811 when it just isn't there. Thus, readers get "Lost in Translation" or, in the worst case, they get a wrong idea and think that Lagrange was actually doing symplectic geometry in 1811.

Writing the history of symplectic geometry can be a problem too, because there where many mathematicians that contributed to the development of the field without working as a "collective". Here we have Carl Ludwig Siegel who, in 1943, published a paper titled "Symplectic Geometry", while the Chinese Loo-Keng Hua independently discovered very similar results. In France, Charles Ehresmann and Paulette Libermann classified the differential forms and symplectic forms in 1948/49, therefore arriving at the symplectic manifold, but in China, Hwa-Chung Lee had described the symplectic manifold already in 1943, without Ehresmann nor Libermann knowing about it.

I want to present my attempt at solving these problems, so that I will be able to "Read and Write the History of Symplectic Geometry" in the end.

KATRIN REIMANN:

ON THE UNDERSTANDING OF THE CONCEPT OF NUMBERS IN EULER'S ALGEBRA

Numbers and variables in modern mathematics are seen as abstract objects. The concept of numbers and variables is very important for the understanding of mathematics in general and especially for algebra. In this presentation I would like to give an insight into the concept of numbers by Euler in his textbook "Vollständige Anleitung zur Algebra". Against the modern view, Euler considers numbers as objects out of the empiricism. His understanding of numbers differs in regard to different number ranges such as whole numbers and complex numbers. The complex number is for Euler an impossible number, with which one can operate but which is no object of the theory. Euler's understanding of variable is bound to the concept of numbers and he handles them as if they were concrete numbers. It can be seen clearly that Euler analyses everything, which can be symbolically representable, regardless of the meaning of this symbols.

ELEONORA SAMMARCHI:

READING A MATHEMATICAL MANUSCRIPT: AL-ZANJANĪ'S TREATISE OF ALGEBRA

When we want to read an ancient manuscript written in a foreign language, there are at least three aspects that should be considered in the analysis of the text.

Firstly, the linguistic and philological point of view must be adopted. What does the author mean by choosing certain expressions or terms? What is the most appropriate translation that we can give to them? How could we reconstruct the text if it is incomplete?

Secondly, the mathematical content must be examined.

Thirdly, a historical perspective should be applied. It is worth gathering information about the author,

his education and his working context as well as the background of the manuscript: where and when it was written, how many copies of it we can find at the present time in the world, and so on.

In this sense, the case of al-Zanjanī's treatise of algebra is a typical example of this sort of philological-mathematical and historical work.

After al-Khwārizmī's *Kitāb al-jabr wa al-muqābala*, which gave birth to the constitution of algebra as an independent discipline from geometry and arithmetics, and after Thābit ibn Qurra's contributions, which made this discipline well-founded, the interest of some algebraists shifted to another direction. In fact, at the end of XI century al-Kharajī's school was much more interested in the operations on the unknowns rather than in the theory of equations. The aim was to get to what today we would call polynomial algebra. Al-Zanjanī's work fully belongs to this school. But, who is this mathematician? When and where did he write his treatise of algebra? To those questions we don't have definitive answers until now, and the mentioned "multiple approach" is still in progress.

Despite of that, such sources lead us to interpret the development of mathematics as a collective work, where conceptual revolutions would not be attributed to one or two big names, but, on the contrary, to a research community.

MARIE VETROVCOVA:

GAUSS' LETTERS – TEXTS BEHIND HIS TEXTS

Gauss' opus consists of many papers and works collected into 14 volumes including segments of unpublished texts. To understand the situation and context for arising of Gauss' mathematical works, it is shown that main significance is outlined through his correspondence.

I would like to focus on letters of Carl Friedrich Gauss with his students, Heinrich Christian Schumacher and Friedrich Wilhelm Bessel, their scientific research and situation of mathematical knowledge in Europe in the 1820s. Letters appear a net (or a net-bridge) of forming (nowadays autonomous) disciplines in that time, and they are really a key to understand reasons to coming up of many Gauss' mathematical papers. Selection of examples of Gauss' works is point to arising of Gauss' differential geometry in context of astronomy and geodesy.

This is a contribution to "Writing and Reading the History of Mathematics" in several levels:

- Textual relation of letters and published works (text and corresponding notes and remarks in letters)
- Isaac Newton and Immanuel Kant - philosophical presupposition and imagination of Gauss' mathematical idea
- Gauss' hidden precursors (whose mathematical ideas stand in background of Gauss' crucial texts)
- Interdisciplinary and hermeneutic phenomenological access to history of mathematics as a necessary and/or/not only sufficient condition to decoding original mathematical texts (in context of evident and hidden, or written and non-written knowledge and culture).

MAIRI WALKER:

THE CHANGING PERCEPTIONS OF HENRY ROY BRAHANA'S WORK ON THE CLASSIFICATION OF REGULAR MAPS

The American mathematician Henry Roy Brahana is nowadays considered a key character in the history of regular maps, being the first to attempt to their systematic classification. At the time, however, his work does not seem to have been well-received, and it was over 30 years before any attempt to expand his work was made. I will investigate the changing perceptions of Brahana's work, relating these, where possible, to the more general changes in the perceptions of mathematics that have occurred over the last century.