SEMINAR ON THE "HISTORIOGRAPHY OF MATHEMATICAL SYMBOLISM"

Organized by

Karine Chemla (School of mathematics, The University of Edinburgh,
British Academy Global Professorship)[1]

Agathe Keller (SPHERE, CNRS—University Paris Cité)

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Year 1: 4 February, 18 March, 1 April, 13 May, 17 June 2025, 1pm—5pm

General histories of mathematics seem to agree with the idea that Vieta should be regarded as the first practitioner to introduce symbolic computations in mathematics. However, this conventionnnal historiography of mathematical symbolism has regularly been challenged. Guglielmo Libri (1803-1869) put forward the thesis that in the 13th century Fibonacci already used similar notations. Franz Woepcke (1826-1864) noted the use of similar types of signs in Diophantos' *Arithmetica* and in Sanskrit works translated into English by Henri Thomas Colebrooke in 1817. Woepcke also reported on his discovery of a 15th-century mathematical work from the Maghreb which he believed testified to the introduction of a form of symbolism into Arabic mathematics. Some decades later, Bibhutibhusan Datta and Avadesh Narayan Singh's *History of Hindu Mathematics* further claimed that Sanskrit works testified to the use of mathematical symbolisms. The same holds true for the historiography of mathematical sources written in Chinese. These documents (and others) have been ever since at the center of discussions dealing with both the actual historical origins of mathematical symbolism and its meaning for mathematics. Furthermore, in a different vein, other points of views on the history of mathematical symbolism have been discussed. Thus, in the 1930s, Otto Neugebauer put forward the thesis that the sumerograms used in cuneiform texts played the part of mathematical symbols, in particular because they did not correspond to spoken words. More recently and for a similar reason, Charles Burnett suggested that the decimal place-value notation could be regarded as a form of mathematical symbolism.

The seminar series and the conference will focus on the history of the historiography of mathematical symbolism. The point is not to determine who was actually the first to introduce such notations into mathematics, but rather to analyse what gave rise to these various claims and what historical and philosophical presuppositions about mathematical symbolism underpinned them. Indeed, the claims mentioned above as well as many others illustrate the variety of assumptions about mathematical symbolism that historical analyses have brought into play. It is from this perspective that the seminar is interested in the debates to which this issue gave rise.

The seminar series and the conference have two main aims. The first is precisely to explore the historical shaping of the view that mathematical symbolism originated with Vieta. Secondly, the seminar also hopes to examine the properties and the virtues of mathematical symbolism that different actors have foregrounded in their historical analysis. As such, we are interested in different notions of symbol at play in historians' work only in as much as it explains what they understand as symbolism. For example, what features of symbolism were perceived as central

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when the claim that symbolism was Vieta's invention was (unsuccessfully) challenged by historians on the basis of sources in, e.g., Arabic, Chinese, Latin and Sanskrit? And also, what facets of symbolism have remained overshadowed, or been treated as deriving from properties of symbolism perceived as primary?

Both aims lead to some pivotal questions. A prominent facet of the historical importance given to Vieta's work in relation to mathematical symbolism is the use of literal computation. How did different historians and philosophers understand the specificities and the virtues of this type of computation? How have Vieta's works cast a shadow over most historical discussions on the subject? More largely, what facets of symbolism have been emphasized in relation to the claim that mathematical symbolism was a European invention?

PROGRAM

1pm—5pm
Conference room: 2901

School of Mathematics, The University of Edinburgh
James Clerk Maxwell Building
Peter Guthrie Tait Road
Edinburgh EH9 3FD

The seminar will be held in a hybrid format. You can request a link by writing to karine.chemla@ed.ac.uk

4 February 2025

Karine Chemla (School of mathematics, The University of Edinburgh)
Remarks on the History of the Historiography of Mathematical Symbolism

Abstract: Since the beginning of the nineteenth century, in some historiographies, the history of mathematical symbolism, just as the history of mathematical proof, has been one of the key themes used to assert the distinctiveness of Europe and to set Europe against the rest of the world (or certain parts of Europe against others). In the nineteenth and twentieth centuries, much historical work has been devoted to mathematical sources produced outside of Europe since Antiquity. In this presentation, I will show how, when publications of the latter type addressed the issue of mathematical symbolism, their approach was often comparative and hence informed by early modern developments in mathematical symbolism. I will highlight some of the assumptions about the nature and use of mathematical symbolism that as a result these historical works tacitly adopted. It is all the more important to make these assumptions explicit, since accepting them inevitably lead to the conclusion that mathematical symbolism would be a distinctively European invention. Interestingly, three historians have taken quite different approaches to mathematical symbolism: Otto Neugebauer (1899-1990), when dealing with cuneiform sources; Charles Burnett,

when discussing the nature of decimal place-value notations; and Adolf Pavlovitch Youschkevitch (1906-1993), when discussing Chinese sources. While their approaches remain informed by the experience of modern symbolism, they do so on the basis of different aspects. These works are an invitation to rethink how we might approach the history of mathematical symbolism anew.

Jens Høyrup (Roskilde University, emeritus)
Nesselmann and his Stufen

Abstract: Most of those who have written about the history of algebraic symbolism refer to a tripartite scheme proposed in 1842 by Heinrich Ferdinand Nesselmann. Mostly they claim that it is inadequate; mostly too, however, they do so in ways that suggest that they have not understood what Nesselmann writes, perhaps because he wrote in German, nowadays gradually becoming a dead academic language, and because it was printed in Fraktur, the particular German blackletter type.

In order to make Nesselmann's argument accessible to a generation of scholars who may have lost their German if they ever had it, and who in any case may never have been trained to read *Fraktur*, I shall first go through an English very literal translation of Nesselmann's text. Next I shall apply Nesselmann's categories to select examples from the Italian *abbaco* translation.

Respondents: Agathe Keller (SPHERE, CNRS—Université Paris Cité)**, David Waszek** (post-doctoral fellow, Ecole Normale Supérieure)

18 March 2025

Agathe Keller (SPHERE, CNRS—University Paris Cité)
How historians and orientalists have debated the existence of a symbolism and then of a formalism in Sanskrit mathematical texts. A first overview.

Abstract: When Henry Thomas Colebrooke (1765-1837) published in 1817 translations into English of seventh and twelfth century mathematical texts in Sanskrit, a substantive part of his introduction was devoted to establishing that these texts "possessed" an algebra. Until today, this remains debated. By the end of the nineteenth century, partly due to the works of Georg Heinrich Ferdinand Nesselmann (1811-1881), much of the discussion had to do with establishing whether or not when solving problems in algebra Sanskrit mathematical texts used symbols. However, these early historians of South Asian mathematical texts also noticed all sorts of other notations and marks that could be employed when practicing mathematics. In particular, part of the literature was also devoted to the use or not of a place-value notation when dealing with arithmetical computations.

This talk is a first exploration of the changing definitions and perceptions of the importance of symbols and notations in the discussions on Sanskrit mathematical texts from the early questions of the end of the 18th century raised by John Playfair (1748-1819) to the arguments used by Johan Frederik "Frits" Staal (1930-2012) and Albrecht Heeffer in the second half of the 20th century and the beginning of the 21st. In particular I would like to describe how notations were or not ascribed or related to language. In this first presentation I will focus on the different positions that Léon

Rodet (d. 1895) took on these questions, and the influence he had on the subsequent historiographies.

Benjamin Wardhaugh (University of Oxford)
Mathematical symbolism and its history in the Mathematical and Philosophical Dictionary of Charles Hutton (1795/1815)

Abstract: Charles Hutton (1737–1823) was a pivotal figure in the British mathematics of his generation, by virtue of his dense network of personal relationships, of his much-publicised antagonism to Joseph Banks and by extension the Royal Society, and of a series of magisterial publications including the *Mathematical Tables* (1785), the *Mathematical and Philosophical Dictionary* (1795) and the *Course of Mathematics* (1798). For several decades, his was the leading voice speaking about mathematics in English: and, through reprints and translations of his works, as well as through the long trajectories of his many friends, disciples and students, his views about the nature, function and historical development of mathematics remained widely influential into the middle decades of the nineteenth century. This paper will examine Hutton's construction of a history of mathematical symbolism as articulated chiefly in his 1795 *Dictionary*. Hutton read widely in printed mathematics back to the early sixteenth century and followed closely the new publications of his British and European colleagues, as well as the papers in which Sanskrit mathematics was first presented to a European audience. But he also possessed a distinctive – and distinctively British – agenda, privileging a reliance on spatial and dynamic intuition, and on cognate forms of notation. I will attempt to show how Hutton used these materials to construct his particular –and influential – history of mathematical symbolism.

Respondent: Isobel Falconer (University of St Andrews), **David Waszek** (post-doctoral fellow, Ecole Normale Supérieure)

1 April 2025

Toni Malet (Institut d'Història de la Ciència, Universitat Autònoma de Barcelona)
Symbolization and the Reform of Algebra: Some 17th-Century Views

Abstract: Viète's claim that he was setting up a new, reformed understanding of algebra became popular in many quarters in the early decades of 17th century, although the precise nature of the "new" algebra and its relation to mathematicians of the past remained contested. From the very beginning 17th-century advocates of the new "algebraic style" linked it to specific understandings of mathematical practice, but also to historical views about mathematics' past. As a radical new way to present mathematical arguments, the new algebra was in need of legitimation. We will revise here some of the most substantial 17th-century reflections on **both** the nature of the new symbolization, and the role symbols played in mathematical arguments. We will pay particular attention to John Wallis (1616-1703), who set forth his (in his time) radical defense of the algebraic style in many different places, contexts, and times. He presented his views on algebra and the use of "marks" or "signs" in *Mathesis*

universalis (1657), in his correspondence with Fermat, van Schooten, and others (1658), and most fully in his *Treatise of Algebra* (1685). We will critically present his views on the nature and virtues of the algebraic style — views which were not always consistent in their own articulation, nor with Wallis's mathematical practice. This will allow us to show the historical and moral background that grounded Wallis' advocacy of the new algebraic symbols and their methodological implications.

Giorgio Matteoli (Polytechnic University of Turin)
Interpretations of Mathematical Symbolism in Early General Histories of Mathematical Sciences: Montucla and Savérien

Abstract: tba

Respondent: David Waszek (post-doctoral fellow, Ecole Normale Supérieure)**, Richard Oosterhoff** (The University of Edinburgh)

13 May 2025

Alex Garnick (Harvard University and SPHERE, CNRS—University Paris Cité)- **Karine Chemla**
Echoes and Responses between historiographies of symbolism dealing with Arabic mathematical sources

Abstract: We will start at the end, with the work of late-Ottoman historian of mathematics Salih Zeki Bey (1864-1921) and his intervention, within the pages of *Journal asiatique*, in the historiography of Arabic algebraic symbolism. We will compare his remarks there—which respond directly to Woepcke and Nesselmann—with the different historiographical approach he takes in the second volume of his Ottoman-Turkish-language history of mathematics, *Asar-ı-bakiye.* The latter work was directed at a very different audience from the European orientalists reading *Journal asiatique* and emphasized rather the legacy of Sanskrit mathematical traditions in the development of *ḥisāb* in Arabic. From Salih Zeki, we will work backwards to explore the origins of the historiography which he sought to challenge. We will also analyse how the notations of *hisāb* were discussed from the perspective of a history of mathematical symbolism.

Célestin Xiaohan Zhou (Institute for the History of Natural Sciences, Chinese Academy of Sciences)
Differences in the Understanding of Mathematical Symbolism Between Mathematicians and Historians of Mathematics in 19th and 20th century China

Abstract: This presentation is a continuation of the historiographical research I have conducted within the framework of the SAW (Mathematical Sciences in the Ancient World, ERC) project. There, my analyses of nineteenth- and twentieth-century studies by various types of Chinese scholars reveal significant variation in their interpretations of the same ancient mathematical texts. These differences can

largely be attributed to these scholars' diverse educational backgrounds in mathematics. How do these differences influence their perspectives on the history of mathematical symbolism as evidenced in ancient mathematical texts? In this seminar, I will use some of the views of Li Shanlan (1811-1882), Qian Baocong (1892-1974), and Li Yan (1892-1963) on mathematical symbolism as examples to address this issue within the framework of a new project. Li Shanlan was a prominent mathematician and translator of mathematical works from English into Chinese. In collaboration with A. Wylie, Li Shanlan developed a novel mathematical symbolism for algebra and calculus, drawing on Chinese sources. The motivation and practice of such a creation might highlight his views on the use of symbolism in English mathematical works and in ancient Chinese texts. Li Yan and Qian Baocong, as two founders of the modern history of mathematics in China, offered commentaries on the symbolism in ancient texts informed by their familiarity with modern mathematical symbolism. My presentation will develop a comparison of Li Shanlan's views with those of modern historians of mathematics, highlighting which aspects of symbolism these representative scholars emphasized or neglected. Moreover, as their accounts have likely contributed to shaping our present views on mathematical symbolism, gaining insight into these differences and transformations in the way of viewing the history of mathematical symbolism is beneficial to forming our new comprehension of this issue.

Respondent: tbc

17 June 2025

Ivahn Smadja (Nantes Université, CAPHI - Institut Universitaire de France (IUF))

Signs, symbols and operations: Humboldt's check-and-balance approach to the historiography of mathematical symbolism

Abstract: In this contribution, I will analyze how Alexander von Humboldt addressed central issues in the warp and weft of the historiography of mathematical symbolism, as it took shape in the first half of the nineteenth-century. Owing to a specific check-and-balance "epistolary technique", he created a dialogue between contrasting views, his non-expert status qualifying him as a sounding board resonating with competing historiographic approaches.

I will focus on two different contexts in which Humboldt circulated suggestions, queries and replies on mathematical symbolism, engaging with two different communities, whether with philologists, linguists and orientalists, or with mathematicians and historians of mathematics, whether on ancient numeral systems, or on when, where and how algebra started.

Marie-José Durand-Richard (Honorary Lecturer Université Paris 8 Vincennes & Researcher associated to SPHERE, CNRS, CNRS—University Paris Cité)

Historiography of mathematical notations by Cambridge Algebraists (1820-1845)

Abstract: My talk will analyze how Charles Babbage (1791-1871) and George Peacock (1791-1858) conceived the history of algebraic notations in the first half of

the 19th century. They were mainly guided by John Locke's *Essay on Human Understanding* (1690), for which language, a human creation, is an instrument of thought, and mathematical language is an instrument of reasoning. They also drew on contemporary linguistics, from Degerando's *Des signes et de l'art de penser considérés dans leurs rapports mutuels* (1799-1900) to the accounts of numerous discoverers and travelers. During the decade of the 1820s, Babbage wrote several papers and an unfinished *Philosophy of Analysis*, in which he focused on principles governing the invention of notations, with the opened intention of reforming algebraic language. Later, after publishing his influential *Report on the Recent Progress and Present State of certain Branches of Analysis* (1833), Peacock published a paper entitled "Arithmetic" (1836) *for the Encyclopedia Metropolitana* (1845), which presented a history of algebraic notations based entirely on the idea that an underlying conception of operations presided over the invention of numerical and literal notations throughout the world.

Respondents: Michael Barany (The University of Edinburgh)**, David Waszek** (post-doctoral fellow, Ecole Normale Supérieure), **Deborah Kent** (University of St Andrews)

A conference on the same topic will be held between 15-19 September 2025