

## **Seminar SAW**

### **Seminar History and Philosophy of Mathematics**

### **2011-2016**

organized by Karine Chemla the SAW project's group

Université Paris Diderot, Condorcet Building room 366A - 9:30 am to 5:30 pm  
<http://sawerc.hypotheses.org/seminars/history-and-philosophy-of-mathematics>

### **Programme 2015-2016**

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## December 14<sup>th</sup>, 2015 -Publishing complete works of mathematicians in 19th-century Europe

### Speakers

**Emmylou Haffner**, *Quelques remarques sur l'édition des Gesammelte Werke de Riemann par Dedekind et Weber/Some remarks on Dedekind and Weber's edition of Riemann's Gesammelte Werke*

**Maarten Bullynck**, *The edition of Gauss' works and Goettingen's self-portrayal/Die Gauss-Edition als Projektionsflaeche Goettingischer Selbstdarstellung*

**Christoph Eckes**, *Autour de la publication des œuvres complètes de Hermann Minkowski par David Hilbert, Andreas Speiser et Hermann Weyl*

### **Emmylou Haffner** (SPHERE, CNRS-UPD)

*Quelques remarques sur l'édition des Gesammelte Werke de Riemann par Dedekind et Weber/Some remarks on Dedekind and Weber's edition of Riemann's Gesammelte Werke*

In 1876, the collected works of Bernhard Riemann were published, with additional manuscripts from his Nachlass, by Richard Dedekind and Heinrich Weber. The edition of Riemann's works was a long and difficult work, which took Dedekind and Weber more than two years to complete. Indeed, as the letters exchanged by Dedekind and Weber tell us, the state of Riemann's manuscripts made it necessary for them to thoroughly work through the manuscripts, sometimes struggling to understand what Riemann was doing. We will consider some elements of their correspondence and highlight key points to understand the process of edition through which Dedekind and Weber went, such as the steps followed to unfold Riemann's texts until publishable versions could be obtained. We will suggest that it is important, here, to elucidate to what extent Weber and Dedekind's very thorough editing work led to publish adapted or even rewritten versions of Riemann's texts, and to clarify whether Dedekind and Weber's reading of Riemann could have had an influence on our own reading, through their re-appropriation of Riemann's texts that accompanied the edition of the manuscripts

### **Maarten Bullynck** (Université Paris Vincennes)

*The edition of Gauss' works and Goettingen's self-portrayal/Die Gauss-Edition als Projektionsflaeche Goettingischer Selbstdarstellung*

The talk wants to explore some aspects of the edition of Gauss Werke (1863-1933). This edition was first under Ludwig Schlesinger's direction, later under Felix Klein's supervision. We will look at the scholarly apparatus developed during this edition and its evolution. The focus will be especially on the interaction with contemporary mathematics and the development and promotion of a proper Goettingen school of mathematics.

**Christoph Eckes** (Archives Poincaré, Université de Lorraine)

*Autour de la publication des œuvres complètes de Hermann Minkowski par David Hilbert, Andreas Speiser et Hermann Weyl*

Dans cet exposé, nous reviendrons tout d'abord sur les liens qui unissent Minkowski à Adolf Hurwitz et Hilbert, comme en témoignent notamment les lettres de Minkowski à Hilbert qui s'échelonnent entre 1885 et 1908. Ces lettres ont été publiées par Lily Rüdénberg et Hans Zassenhaus en 1973. Nous aborderons ensuite divers aspects de la Gedächtnisrede que Hilbert adresse en hommage à Minkowski au début du mois de mai 1909 et sur laquelle s'ouvrent les œuvres complètes de Minkowski. Nous étudierons plus largement la structure d'ensemble des œuvres complètes de Minkowski. Nous tenterons en particulier d'identifier les choix faits par les éditeurs pour sélectionner les textes de Minkowski qui composent ses œuvres complètes avant de décrire brièvement leur réception immédiate. Pour finir, nous essaierons de mesurer les incidences des travaux de Minkowski sur Weyl, l'un des éditeurs des œuvres complètes de Minkowski.

In this talk, we will first describe the close links between Minkowski, Adolf Hurwitz et Hilbert, as can be seen from the letters from Minkowski to Hilbert which were written between 1885 and 1908. These letters have been published in 1973 by Lily Rüdénberg and Hans Zassenhaus. Then we will examine the Gedächtnisrede given by Hilbert at the beginning of may 1909 in tribute to Minkowski. This Gedächtnisrede is reproduced at the very beginning of Minkowski's collected papers. More generally, we will study the overall structure of Minkowski's *Gesammelte Abhandlungen*. In particular, we will try to identify the choices made by the publishers in the composition of Minkowski's collected papers before studying their early reception. Finally, we will try to measure the impact of Minkowski's work on Hermann Weyl, who was one of the publishers of Minkowski's collected papers.

Round Table/Table ronde avec **Pierre Chaigneau** (SPHERE, Project ERC SAW)

## January 11<sup>th</sup>, 2016 - History of the historiography of algebra

### Speakers

**Jens Høyrup**, *What is "geometric algebra", and what has it been in historiography?*

**TIAN Miao**, *Western and Chinese Algebraic Methods in 19th Century Chinese Historical Works*

**Marie-José Durand-Richard**, *The English algebraists' view of historiography of algebra*

**Simon Decaens**, (Université Paris Diderot, SPHERE)

*The history of American abstract algebra, two accounts by E. T. Bell and G. Birkhoff*

**Jens Høyrup** (Roskilde University)

*What is "geometric algebra", and what has it been in historiography?*

**Abstract** - This title is adapted from that of Hans Freudenthal's contribution to a famous debate dealing not least with the interpretation of ancient Greek geometry through the concept of "geometric algebra". Freudenthal argued that through this concept it was possible to point to an underlying unity of algebra, in spite of historical transformations. The present contribution, looking at the main creators and users of the notion of a "geometric algebra" since the 1880s, that their explanations of what they intend by the term and their use of it changes so fundamentally from one of them to the other that it is difficult to argue for even an underlying unity, and that the use of shared words means little more than, exactly, shared words.

**TIAN Miao** (Institute for the History of Natural Sciences, CAS, Beijing)

*Western and Chinese Algebraic Methods in 19th Century Chinese Historical Works*

**Abstract** - At the beginning of 18th century, European algebra, *Jie genfang*, was transmitted into China by Jesuit missionaries. It was soon accepted by Chinese mathematicians. It is based on the study of European algebraic method, the old Chinese *Tianyuan* method was rediscovered, and the two methods were regarded as identical at the beginning. In the second half of the 18th century, in the context of research and publication of ancient works in China, most of old Chinese mathematical books became accessible to mathematicians and scholars. Aim at the fully understanding of ancient knowledge and texts, some Chinese mathematicians focus on the study of 13th century Chinese mathematical texts concerning *Tianyuan* algebra, even they fully understand the advantage of European algebra. However, they reach the result that Chinese methods have more advantage than the ones from Europe. at the beginning of the 19th century, there was a hot debate among Chinese mathematicians about the advantage and disadvantage of

Western and Chinese algebraic methods. In this paper, I will focus on the following problems:

- 1) The context of the study of Algebra method in the 19th century China.
- 2) The attitude of Chinese mathematicians toward the algebraic method from Europe and China in historical works.
- 3) The attitude of Chinese mathematicians toward the theoretical knowledge unveiled in their study concerning algebra.

**Marie-José Durand-Richard** (SPHERE-UMR 7219, CNRS & Université Paris-Diderot)

*Le point de vue des algébristes anglais sur l'historiographie de l'algèbre*

**Résumé** - Les algébristes anglais de la première moitié du 19<sup>ème</sup> siècle, en particulier George Peacock (1791-1858) et Augustus de Morgan (1806-1871), inaugurent un vaste programme de restructuration de l'algèbre, à des fins à la fois pédagogiques et épistémologiques, voire politiques. Leur conception de l'algèbre s'appuie sur une philosophie empiriste et sur une conception du langage mathématique comme aboutissement d'un processus de symbolisation. Leur conception de l'histoire de l'algèbre s'articule ainsi à l'histoire de l'arithmétique. L'exposé s'attachera à examiner comment ils envisagent comme un même processus l'élaboration de l'algèbre en Inde, dans le monde arabe et en Italie.

*The English algebraists' view of historiography of algebra*

**Abstract** - English algebraists of the first half of the 19th century, notably George Peacock (1791-1858) and Augustus de Morgan (1806-1871), initiated a large program restructuring algebra, for both pedagogical, epistemological and even political purposes. Their conception of algebra was founded on an empiricist philosophy and on a view of mathematical language as the culmination of a symbolizing process. So, their views on the history of algebra is articulated on the history of arithmetic. This talk will focus on examining how they considered in a same process the development of algebra in India, in the Arabic world and in Italy.

**Simon Decaens** (Université Paris Diderot, SPHERE)

*The history of American abstract algebra, two accounts by E. T. Bell and G. Birkhoff*

**Abstract** - In 1938, E. T. Bell presented « modern abstract algebra » as a very recent trend in America. Although « practically all German » in its history, it was carried by a american « vigorous young school ». In this talk, I would like to discuss two different images of this history of an American abstract algebra. First, we will focus on Bell's history of algebra in the 1930s. We will see how his specific way of presenting the development of mathematics by « abstraction » is linked to his definition of abstract algebra as a theory of structures. In a second part, we will use historical papers by G. Birkhoff from the 1970s to look at the same issue from an other point of view. In particular, in both historical presentations, we will question the use of national categories and their link to the history of algebra.

**March 7<sup>th</sup>, 2016 - Historical approaches to the history of  
indeterminate analysis / Approches historiques à l'histoire de  
l'analyse indéterminée**

**Speakers**

**Ivahn Smadja**, *On Two Conjectures That Shaped the Historiography of Indeterminate Analysis : Strachey and Chasles on Sanskrit Sources*

**Karine Chemla**, *Remarks on the historiography of the Chinese remainder theorem in the 19th and 20th century*

**Agathe Keller**, *Unravelling Libbrecht's kuṭṭaka*

**Ivahn Smadja** (ERC Project SAW & SPHERE, CNRS & Université Paris Diderot)  
*On Two Conjectures That Shaped the Historiography of Indeterminate Analysis : Strachey and Chasles on Sanskrit Sources*

**Abstract** - This paper is part of a research project on the historiography of mathematical proof in ancient traditions. Its purpose is to shed light on the various ways in which nineteenth-century European scholars attempted to make sense of Sanskrit mathematical sources dealing with indeterminate analysis. Attention will be paid to the historical processes by which these different strands interwove into a cumulative historiography of the field. The focus is on two interpretive conjectures that shaped alternative readings of an evolving corpus of texts, with significantly different emphases and viewpoints.

The British scholar and EIC servant Edward Strachey first identified a consistent algebraic theory in Bhāskara's Bīja-gaṇita, which he translated from a seventeenth-century Persian manuscript. While reading his sources through the lens of the Euler-Lagrange theory of periodic continued fraction expansions for quadratic irrationals, he offered an insightful interpretation of the so-called cakravāla, or « cyclic method ». Two decades later, in the context of his investigations on the historiography of geometry, the French geometer Michel Chasles delved into Henry Thomas Colebrooke's translations of Bhāskara and Brahmagupta, from the Sanskrit original, which had become authoritative all over Europe in the meantime. While working out an overall interpretation of Brahmagupta's theory of quadrilaterals, Chasles incidentally spotted a geometrical construction which opened the way to a geometrical solution of the indeterminate equation  $Cx^2 \pm A = y^2$ . He conjectured that this geometrical way may have been the Sanskrit path to indeterminate analysis. Furthermore, on the basis of textual reconstruction, he supplemented his rigorous interpretive conjecture with a more sweeping historical assumption about a possible transmission of this geometrical approach to algebra, from Sanskrit to European mathematics, through the Arabs and Fibonacci. Owing to further scholarship by Boncompagni, Woepcke and others, the wheat would be sorted out from the chaff.

**Karine Chemla** (ERC Project SAW & SPHERE, CNRS & Université Paris Diderot)

*Remarks on the historiography of the Chinese remainder theorem in the 19th and 20th century*

**Abstract** - In *Jottings on the science of the Chinese. Arithmetic* (hereafter abbreviated to *Jottings*), which the protestant missionary Alexander Wylie published in 1852, he presented for the first time to a European audience elements of a history of indeterminate analysis in China. His publication also included an outline of a comparison with Sanskrit sources Ulrich Libbrecht has analyzed the reception of this part of Wylie's book, showing how it had been mistranslated and thus misinterpreted. Ulrich Libbrecht has further examined the most significant contribution to this field in China, in the 13<sup>th</sup> century mathematical book by Qin Jiushao. The talk intends to examine the historiographic principles that have presided over the analysis of Qin Jiushao's work in these various publications, and the part the topic of indeterminate analysis has played in the European historiographies of mathematics in ancient China and of indeterminate analysis

**Agathe Keller** (ERC Project SAW & SPHERE, CNRS & Université Paris Diderot)  
*Unravelling Libbrecht's kuṭṭaka*

**Abstract** - In Chapter 14 of his 1973 *Chinese Mathematics in the Thirteenth Century. The Shu-shu chiu-chang of Ch'in Chiu-shao*, Ulrich Libbrecht discusses a reconstruction of what is both a procedure of resolution and the name of the problem to be solved in Sanskrit sources: the *kuṭṭaka* (pulverizer). He then proceeds in Chapter 18 to compare the algorithm he has reconstructed with what he calls the *Ta-yen* rule. This presentation will look at the basis and sources with which Libbrecht made his reconstructions, hoping to also shed light on how he constructed his comparaisons, and how he understood the arithmetical and algebraical objects of Sanskrit sources he was dealing with.

**Résumé** - Détricotage du *kuṭṭaka* de Libbrecht  
Dans le Chapitre 14 de son *Chinese Mathematics in the Thirteenth Century. The Shu-shu chiu-chang of Ch'in Chiu-shao* publié en 1973, Ulrich Libbrecht discute et propose une reconstruction de ce qui est, dans les sources sanskrites, tout à la fois un algorithme et le problème qu'il résout: le *kuṭṭaka* (pulvérisateur). Par la suite, dans le Chapitre 18, il compare cet algorithme reconstruit avec ce qu'il nomme « la Règle du Ta-yen ». Cette présentation observera les fondements et les sources sur lesquelles repose la reconstruction de Libbrecht, dans l'espoir d'éclaircir comment il construit ses comparaisons et comment il comprenait les objets arithmétiques et algébriques des sources sanskrites avec lesquels il travaillait.

## April 4<sup>th</sup>, 2016 - Mathematical work on measurement units / Le travail mathématique sur les unités de mesure

### Speakers

**Thomas Morel**, *Les unités de mesure en géométrie souterraine (XVI<sup>e</sup>-XVIII<sup>e</sup>) / Subterranean geometry and its measurement units (16<sup>th</sup>--18<sup>th</sup> centuries)*

**Charlotte de Varent**, *Apports de la diversité de systèmes métrologiques anciens à l'enseignement aujourd'hui: réflexion croisée avec les manuels scolaires de CM2 / Contributions of ancient metrological systems' diversity to the teaching of today: comparative reflections with elementary textbooks from the fifth grade*

**Marc Moyon & Maryvonne Spiesser**, *Surface de rectangles et unités de mesure chez Léonard de Pise (13<sup>e</sup> siècle) / Rectangular Surfaces and Units of Measurement with Leonardo of Pisa (13<sup>th</sup> century)*

**Eric Vandendriessche**, *Estimations des quantités d'ignames dans les îles Trobriand / Estimating quantities of yams in the Trobriand Islands*

**Thomas Morel** (Laboratoire de Mathématiques de Lens, Université d'Artois)  
*Les unités de mesure en géométrie souterraine (XVI<sup>e</sup>-XVIII<sup>e</sup>) / Subterranean geometry and its measurement units (16<sup>th</sup>--18<sup>th</sup> centuries)*

**Résumé** -La géométrie souterraine était une discipline mathématique pratique visant à améliorer, planifier et faciliter l'exploitation des mines. Elle s'est principalement développée à partir du XVI<sup>e</sup> siècle dans les États-miniers de l'espace germanophone. Ces régions possédaient donc des systèmes juridico-techniques particuliers, ce qui implique notamment des unités de mesures spécifiques. Dans une première partie, je proposerai un aperçu des unités de mesures utilisées et décrites aussi bien dans le *De Re Metallica* de G. Agricola que dans divers statuts miniers d'Europe centrale. Dans un second temps, j'expliquerai comment les géomètres souterrains (*Markscheider*) manipulaient ces unités pour la résolution de divers problèmes (litige de propriété, calculs de direction, ...). J'étudierai dans un troisième temps deux exemples spécifiques de normalisation ayant eu lieu à la fin du XVIII<sup>e</sup> siècle en Saxe : la détermination de la toise (*Lachter*) et la standardisation du volume et de la forme des baquets (*Kübel*) de mines.

**Abstract** - Subterranean geometry belonged to the practical mathematical disciplines and aimed at improving and planning mining operations. It developed from the 16<sup>th</sup> century onwards in the mining states of central Europe. These regions had distinctive juridical and technological systems, which implies, amongst others, that they had specific measurement units. Firstly, I will give an overview of the measuring units that were used and described both in G. Agricola's *De Re Metallica* and in various mining laws of central Europe. Secondly I will explain how the subterranean geometers (*Markscheider*) would use these units for the resolution of various problems (setting property limits,



calculating directions). Thirdly, I will focus on two case studies for the normalization that occurred in late 18<sup>th</sup> century Saxony: the determination of the fathom (*Lachter*) and the standardization of volume and shape of the mining hoppits (*Kübel*).

**Charlotte de Varent** (SAW Project, SPHERE)

*Apports de la diversité de systèmes métrologiques anciens à l'enseignement aujourd'hui: réflexion croisée avec les manuels scolaires de CM2 / Contributions of ancient metrological systems' diversity to the teaching of today: comparative reflections with elementary textbooks from the fifth grade*

**Résumé** - J'examinerai le statut des unités de mesure dans les séquences d'introduction au calcul de l'aire du rectangle en CM2. Je croiserai cette approche des unités de mesure avec d'autres systèmes métrologiques, provenant des sources en sanskrit, chinois et cunéiforme. Je me servirai de cet exemple géométrique pour questionner l'introduction de la métrologie dans l'enseignement élémentaire des mathématiques.

**Abstract** - I intend to investigate the status of measuring units in teaching sequences, introducing the area of the rectangle in the fifth grade. I compare this approach of measuring units with other metrological systems from sanskrit, chinese and cuneiform sources. I use this geometrical example to interrogate the introduction of metrology in elementary teaching of mathematics.

**Marc Moyon** (Université de Limoges) & **Maryvonne Spiesser** (Université Paul Sabatier de Toulouse)

*Surface de rectangles et unités de mesure chez Léonard de Pise (13e siècle) / Rectangular Surfaces and Units of Measurement with Leonardo of Pisa (13th century)*

**Résumé** - Nous centrons notre travail sur le premier chapitre de la *Practica Geometriae* de Fibonacci, dans lequel l'auteur propose de calculer la surface de rectangles étant données leurs dimensions. Si les algorithmes utilisés sont élémentaires, leur mise en œuvre l'est un peu moins. En effet, l'objectif de Fibonacci est bien de pouvoir calculer ces surfaces quelles que soient les unités et sous-unités de mesure utilisées. Nous détaillons donc ici une 'série de problèmes' réfléchi à partir desdites unités pour mettre en évidence l'utilisation des différents outils mathématiques, et notamment des fractions, de l'auteur pisan.

**Abstract** - We focus our work on the first chapter of the *Practica Geometriae* of Fibonacci, in which the author proposes to calculate the area of rectangles given their dimensions. Although the algorithms used are elementary and well-known, their implementation is not as simple as it may seem. Indeed, the purpose of Fibonacci is to calculate these surfaces regardless of the units and subunits of measurement used. We detail here a 'set of problems' reflected from units to demonstrate the use of various mathematical tools, including fractions, by the author from Pisa.

**Eric Vandendriessche (SPHERE)**

*Estimations des quantités d'ignames dans les îles Trobriand / Estimating quantities of yams in the Trobriand Islands*

**Résumé** - Comme très souvent en Mélanésie (Pacifique sud), la culture des jardins est le principal mode de subsistance des Trobriandais de Papouasie-Nouvelle-Guinée. Parmi les tubercules cultivés dans cette société, les ignames ont une place primordiale, et les performances individuelles pour leur production sont socialement valorisées. Après la récolte, chaque jardinier organise sa production d'ignames en un « tas » de forme conique, préparant ainsi un moment ritualisé dont l'enjeu est de mesurer et de comparer les productions de chacun. Dans un premier temps, je décrirai la méthode employée par les Trobriandais qui réalisent ces mesures à l'aide d'un système de numération et de mesure traditionnel. Dans un second temps, nous verrons que des unités de mesure corporelles permettent aux Trobriandais d'estimer - avant le 'rituel' de comptage des ignames - la quantité de tubercules contenue dans chaque tas. Des paris sont alors organisés sur la base de ces estimations.

**Abstract** - As is generally the case in Melanesia (South Pacific), making gardens is the main livelihood of the Trobriand Islanders from Papua New Guinea. Among the tubers grown there, yams are of fundamental importance, and individual performance for cultivating them is socially valued. After the harvest, all gardeners pile up their crops of yams in cone-shaped stacks, in preparation for the ritual of measuring and comparing the sizes of each crop. First, I will describe the Trobrianders' method for counting yams, which is based on a traditional system of numbers and measurement. Secondly, we will see that body measurement units enable Trobrianders to estimate—before the yam-counting ritual—the quantity of yams contained in each stack, allowing them to make bets on the basis of these estimations.