Special Issue – Women in Sciences: Historiography of Science and History of Science – on the Work of Women in Sciences and Philosophy

Women and Logic: What Can Women's Studies Contribute to the History of Formal Logic?[1]

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With a commentary by Andrea Reichenberger[3]

Abstract:

Beiküfner's report reflects on woman's place in the history of logic. These reflections date back to a larger research project entitled *Case Studies Towards the Establishment of a Social History of Logic* (1985–1989). The project was initiated under the direction of Professor Christian Thiel, University of Erlangen-Nuremberg, and funded by the German Research Foundation DFG. The main focus of the Erlangen research project was laid in the historical analysis of the emergence of modern logic in Great Britain and Germany during the 19th and early 20th century. This research prompted the discovery of a series of important female authors in the Anglophone and German speaking area. This led, firstly, to the question of what might be gained from the research results for the project's objectives and, secondly, to a closer examination of the methodological demands and problems of a feminist historiography of science.

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In today's lecture, I do not want to present any new research results, but rather perform a stocktaking of my previous work. Particular research projects in the field of "Women and Logic", or "Women in the History of Logic", could be continued in various directions. Within

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[1] The following article is the English translation of a short report by Karin Beiküfner. The German original was published in 1989 as "gray literature" within the research project *Case Studies Towards the Establishment of a Social History of Logic* (1985–1989), funded by the German Research Foundation – DFG. Thus, with this English version republished in a journal directed towards a large and specialized audience, we hope to give Beiküfner's ideas the attention they deserve. Karin Beiküfner: "Frauen und Logik. Was kann Frauenforschung für die Geschichte der formalen Logik leisten?" *Arbeitsberichte aus dem DFG-Projekt Fallstudien zur Begründung einer Sozialgeschichte der Logik*, No. 25, [Erlangen] July 1989, pp. 22–26. We would like to thank the author Karin Beiküfner and the editors of the report series, Volker Peckhaus and Christian Thiel, for their permission to translate and publish the contribution.

[2] Karin Beiküfner is a former member of DFG project *Case Studies Towards the Establishment of a Social History of Logic* (1985–1989) which was initiated under the direction of Professor Christian Thiel, University of Erlangen-Nuremberg. As a graduate student, she has written 13 reports within the project. After completing her master's degree, she worked for private foundations dedicated to the promotion of interdisciplinary research.

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the framework of our research project, the current problem is, therefore, the weighting of the particular research directions and the integration of women's works in the context of the overall project.

Since the topic "Women in the History of Logic" was not initially part of our research project, I would like to briefly describe how this research came about. In the history of logic, several authors mention female logicians. However, hardly any details about these women are given. Therefore, we picked them out and investigated them in the same manner as the other authors. First, the most important biographical and bibliographical data were determined. In this context, it quickly became clear that these female logicians worked in completely different social and institutional environments. Further, the conditions under which they developed their contributions to formal logic were substantially different from those of their male colleagues.

The question as to how the unequal conditions of scientific work for men and women could be taken into account led to a closer examination of the methodological demands and problems of a feminist history of science. The subject of this still very young discipline is the question of how women can be methodologically recorded as subjects and objects of historiography. Initially, our project *Case Studies Towards the Establishment of a Social History of Logic* was not intended as a feminist project in which the discovery and research of women in the history of logic occupy a central position. This led to the question of what might be gained from the research results for the project's objectives and how the newly developed sub-project "Women in the History of Logic" can be integrated into the overall context of the project. We defined the following six areas of research:

Biographical Research

A major focus, especially at the beginning, was the compilation of the most important biographical data of those women who were mentioned in works on the history of logic and by logicians. Among others, *Christine Ladd-Franklin, Emily Elizabeth Constance Jones, Susanne K. Langer, Grace Chisholm Young, Janina Hosiasson, Lizzie Susan Stebbing*, and *Sophie Bryant* were recorded. In the near future, the biographical data regarding *Marie Deutschbein* and *Jane A. Winscom* will have to be supplemented, but this still requires further extensive historical research.

Bibliographical Research

Subsequent to the data collection and biographical overview, a compilation of the works published by the respective female logician is planned, which is currently only available from E. E. C. Jones.[4] Bibliographical material on the other female logicians is only fragmentarily available so far. The acquisition of the logical works also encounters some technical difficulties, since not all monographs or journals, in which the women have published their works, are accessible via the national library lending system. The purpose of the bibliographical research is to answer the question of what importance the logical works have concerning the female authors' oeuvre as a whole and how their contributions to formal logic are to be evaluated.

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[4]Unfortunately, this bibliography of the works of E. E. C. Jones cannot claim to be complete. See Karin Beiküfner, "A New Law of Thought? Zur Biographie der Werke von Emily Elizabeth Constance Jones", *Arbeitsberichte aus dem DFG-Projekt Fallstudien zur Begründung einer Sozialgeschichte der formalen Logik* No. 21 (December 1988), 18–26.

Documentation and Evaluation of Logical Works

A substantive discussion of the works written by female logicians has so far only be done for Christine Ladd-Franklin.[5] The connection to other logicians and the reception of their works has to be examined.

Reception of the Works of Female Logicians

Starting from women's writings on logic, the question must be asked in which context these works were created, and which influences become visible, i.e., whether and in what way these works refer to other logicians. Conversely, it is necessary to examine by whom and in what way the logical works of women were received. In this context, particular attention is paid to the question whether the fact that these authors were female logicians influenced their reception.

The History of Institutions

The reconstruction of the conditions under which women worked in the field of formal logic includes, besides the investigation of the socio-cultural environment, a history of the institutions providing the possibility of scientific activity, i.e., the educational institutions accessible to women. For the period of our project, the problem of women's education and access to scientific institutions was at the center of the demands of the feminist movement. So far, the history of women's studies and the discussion on the admission of women to higher education have been outlined for the nations of Germany, Switzerland, England and the United States of America, which were relevant to the development of formal logic. In addition to the general scientific working conditions, the question of the possibilities of working in the field of logic and participating in the internal discussions in this field is to be answered in particular.

Methodological Problems of the Integration of Female Logicians in the Overall Context of the Research Project

Finally, the different working conditions for women compared to those for men require a methodological reflection on the treatment of female logicians within the framework of a social history of formal logic. The question of how the different working conditions that were and are valid for women should be taken into account is not only an important part of fundamental considerations in writing the history of logic, but also in the historiography of other scientific disciplines. The criticism of traditional sciences studies from feminist perspectives as well as several feminist positions regarding the philosophy of science has already been discussed and will be published in the near future.

Open Questions

The research results on women in the history of logic raise a whole series of specific historical and methodological-theoretical questions that are currently still unanswered and probably cannot be answered satisfactorily within the time-frame of the project. The current interesting questions are as follows:

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[5] See Volker Peckhaus, "Brilliant young lady-mathematician – Ernst Schröders Urteil über Christine Ladd-Franklin", *Arbeitsberichte* No. 16 (March 1988), 38–54.

- How can women's studies be legitimized within a history of logic which is the subject of our project?

- Can the impression be verified that the percentage of women in the formal sciences – logic and mathematics – is significantly high? Is a comparison with other disciplines at all possible or meaningful?

- Is there a demonstrable connection between the activities of women in the scientific field and their involvement in the feminist movement?

- Can the social-historic approach to the history of logic be combined with the demands of a feminist history of science, or at least brought into accordance?

A well-founded answer to these questions presupposes, however, that the historical research on women in the history of logic is first continued.

Commentary by Andrea Reichenberger

The DFG project *Case Studies Towards the Establishment of a Social History of Logic* (1985–1989) was initiated under the direction of Professor Christian Thiel, University of Erlangen-Nuremberg. Christian Thiel has worked on topics related to the history of modern science, in particular on the logic of the 19th and 20th centuries and the work of Gottlob Frege (Thiel 1965, 1982, 1995, 2006). The members of the research group were (in alphabetical order): Karin Beiküfner, Thony Christie, Randolf Hümmer, Volker Peckhaus, and Michael Sperl. The members of the committee with whom there was an exchange of experiences and research results were: Irving H. Anellis, Ivor Grattan-Guinness, Gerhard Heinzmann, Dieter Hoffmann, Lothar Kreiser, Albert Lewis, and Jan Woleński. A total of 97 reports written by the members of the research group were published as "gray literature".

Volker Peckhaus has written two reports on the status of the project, one for the period from 1985 to 1987, the other for the period from 1987 to 1989 (Peckhaus 1989; see also Peckhaus 1986 and Peckhaus 1997). Both reports together give us a well-founded overview of the research organization and document the research process. They summarize the aims and scopes of the theoretical framework of a social history of logic by emphasizing the primacy of a problem-oriented reconstruction of ideas.

The methodology of the project, called "Contextual historiography of scientific disciplines" (see Peckhaus/Thiel 1999), was divided into two parts: a quantitative data collection and a qualitative analysis. At the end of the project, the databases consisted of 1025 persons. The qualitative analysis was divided into three topics: (i) case studies about logicians, (ii) case studies about logical textbooks, (iii) case studies about teaching classes. The focus was on the historical development of the algebraization of logic in Great Britain and Germany in the 19th century and the institutionalization of mathematical logic in the early 20th century. A Documentation Center for the History of Formal Logic was planned, but could never be realized. The Erlangen Logic Documentation is now at Paderborn University, in the archive at the professorial chair of Volker Peckhaus.

Research on female logicians within the DFG project was prompted by a series of important contributions to modern logic by female authors in the Anglo-American area, among them Christine Ladd-Franklin and Emily Elizabeth Constance Jones. In Peckhaus' reports, this research is subordinated under historical research on education and plays only a minor role.

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At the end of the project's period, the "Erlangen Documentation" included 60 female logicians from twelve countries, 22 of whom are also mentioned in Alonzo Church's *Bibliography of Symbolic Logic* (Church 1936/1984). The period of coverage begins in 1725 with Johanna Charlotte (Unzer 1751). In total, the documentation recorded sixteen German-speaking women: Lilly Buchhorn, Marie Deutschbein, Olga Hahn, Elli Heesch, Grete Henry-Hermann, Lily Herzberg, Philippine Freiin v. Knigge, Edith Landmann, Hilda v. Mises, Martha Moers, Wilma Papst, Rosemarie Rheinwald, Amalie Rosenblüth, Karoline Schelling, Johanna Charlotte Unzer, Elisabeth Walther-Bense.

Pioneering work in this field has been carried out by Karin Beiküfner, supported by the Erlangen group members Michael Sperl, Christian Thiel, and Volker Peckhaus. Their reports were published as "Arbeitsberichte" within the Erlangen-DFG-project. Most of them were never published anywhere else. Karin Beiküfner has written 13 reports: "Christine Ladd-Franklin und die John Hopkins University", "Sophie Bryant (1850–1922)", "Emily Elizabeth Constance Jones (1848–1922)", "Christine Ladd-Franklin (1847–1930)", "A New Law of Thought? Zur Bibliographie der Werke von Emily Elizabeth Constance Jones", "Zum Frauenstudium in den USA. Christine Ladd-Franklin und die Johns Hopkins University", "Zum Frauenstudium in Deutschland: Sonja von Kowalevsky in Heidelberg", "Die Entwicklung des Frauenstudiums in Deutschland zwischen 1850 und 1910", "Berichte ausländischer Studentinnen über ihr Studium an deutschen Universitäten Ende des 19. Jahrhunderts", "Der Beginn des Frauenstudiums in Großbritannien", "Frauen in der Wissenschaftsgeschichte. Überlegungen zu einem frauenspezifischen Zugang", "Schreiben Frauen eine andere Wissenschaftsgeschichte? Zur feministischen Diskussion der Wissenschaftsforschung", "Frauen und Logik: Was kann Frauenforschung für die Geschichte der formalen Logik leisten?".

Michael Sperl has contributed to Janina Hosiasson-Lindenbaum, Susanne Katharina Langer, and Lizzie Susan Stebbing and Volker Peckhaus to Christine Ladd-Franklin and Olga Hahn. Christian Thiel has reported on "Davies' (Psycho-)Logical Ladies", and "Zur Mitarbeit von R. Adamson, C. Ladd-Franklin und C. S. Peirce an Baldwins Dictionary of Philosophy and Psychology." Thiel has also published an article about "Philippine Knigges Versuch einer Logic für Frauenzimmer", in: *Adolph Freiherr Knigge in Kassel*, ed. Birgit Nübel (Weber & Weidemeyer: 1996, 98–06).

The Erlangen work on women in logic was later continued by Adelheid Hamacher-Hermes in the RWTH-funded project *Women in Logic at the Beginning of the 20th Century in Germany* at the University of Aachen (1994–1996). Her final report (Hamacher-Hermes 1996) includes short biographical and bibliographical information as well as documentation and evaluations regarding the following women: Buchhorn, Lilly; Deutschbein, Marie Anna; Haack, Hildegard; Hahn, Olga; Heesch, Elli Johanna Anna; Herzberg, Lily, *née* Wagner; Kahl-Furthmann, Gertrud, *née* Furthmann; Krenz, Editha; Landmann, Edith , *née* Kalischer; Mises, Hilda v., *née* Geiringer; Matzun, Uta; Moers, Martha Franziska Constanze; Papst, Wilma; Rand, Rose; Rosenblüth, Amalie; Schmitz, Thekla. Hamacher's comprehensive report never officially appeared. She published two articles, one about Rose Rand (Hamacher-Hermes 2003), another about Elli Heesch (Hamacher-Hermes 2008).

Both Hamacher and Beiküfner's research intended to make the contributions of women visible and to evaluate their works for the developments in logic under their particular conditions of origin. Against this background, Beiküfner and Hamacher-Hermes have investigated the educational situation of women at the beginning of the 20th century in Germany, after the universities were opened to women. The demonstrably good performance of women in the formal sciences, especially in mathematics, has encouraged discussions about women and logical thinking worldwide (or, at least, in the Western world). In 1893, Christine Ladd-Franklin, well-known for her contributions to symbolic logic and the

theory of color vision, intervened in the discussion. In her article "Intuition and Reason" in *The Monist*, Ladd-Franklin remarked:

> It is not true that men's minds and women's minds have a different way of working; […] It is not true that the Creator has made two separate kinds of mind for men and for women; but it is true that society, as at present constituted, offers two somewhat separate fields of interest for men and for women, and that the nature of their conduct is of necessity determined by the character of the action which is demanded of them. (Ladd-Franklin 1893, 211f.)

Christine Ladd-Franklin's strong passion for promoting and advancing women in academia is one of many examples for the impact of the feminist movement on science and on the education system in the late 19th century. During this period, a number of articles and monographs appeared on this topic. Noteworthy is Alphonse Rebière's book *Les femmes dans la science*, published in 1894 (Rebière 1894). It followed the encyclopedia format, listing the women alphabetically, giving their names, dates of birth, the social conditions under which they had lived, their contributions and publications. Also in Germany, renowned mathematicians were committed to the advancement of women, among them Wilhelm Lorey, Felix Klein, and David Hilbert. In Germany, the controversy over the admission of women to universities culminated at the end of the 19th century. In November 1895, Berlin newspapers announced that Heinrich Treitschke and Eric Schmidt had expelled several women from their classes. In the following year, the theologian Arthur Kirchhoff invited 103 leading university professors and intellectuals (all males) to discuss the prospects of admitting women to German universities (Kirchhoff 1897). In Kirchhoff's volume, several famous scientists advocated better educational opportunities for women, among them Felix Klein, who highlighted foreign female mathematicians as outstanding examples. However, some of them also expressed deep prejudices about women's academic work, among them Max Planck.

The undeniable gender differences in academic careers are well and widely explored. In comparison, there are hardly any studies about female logicians in German-speaking countries until today. Beiküfner and Hamacher-Hermes' studies are one of the few exceptions. A problem-oriented integration of women's contribution within the framework of a social history of logic and its reconstruction of ideas is missing until today. The focus of the Erlangen research project, namely the historical development of modern logic in Great Britain and Germany, would have been perfectly appropriate for this purpose. At this point, we want to give an outlook for highly relevant possible research in the near future.

According to widespread opinion, "the great epoch in the history of logic did open in 1879, when Gottlob Frege's *Begriffsschrift* was published" (van Heijenoort 1967, vi). This work "presented to the world, in full-fledged form, the propositional calculus and quantification theory" (ibid.). Frege rested his logic not on the distinction between propositions and terms or between subject and predicate but instead on the distinction between function and argument. Therefore Frege is often called the founder of modern logic. Historians of logic have criticized that the claim of a "Fregean" revolution neglects the complexity of the historical development and reduces the algebraic logic of Augustus De Morgan, George Boole, Charles Sanders Peirce, and Ernst Schröder as belonging to the Aristotelian tradition. Today, there is a broad agreement that when Frege published his quantification theory, an equivalent one was (being) developed at the same time in the school of Charles S. Peirce, later taken over by Schröder, and extensively discussed in the second volume of the *Vorlesungen über die Algebra of Logik* (Schröder 1891). Later, the theory of quantification became known as classical first-order logic. The early part of the 20th century witnessed the discovery of many of its deepest properties through the development of metalogic and proof

theory, especially in the form of model theory and recursion theory. That is all well-known, thoroughly documented and widely discussed.

It is an astonishing fact that women's contribution to that development are excluded from standard textbooks and introductions until today, although many of their works have been known for a long time and are the subject of well-funded historiographical studies. The new view of algebra as the study of operations captured by rules for the symbolic manipulation of formulae suggested the possibility of applying this approach to domains other than numbers, or mathematics in general. It was Ada Lovelace who hinted at this in her brief proposal of a machine to compose music (see Priestley 2011, 68; Hollings et al. 2017). The first application of these ideas to a domain outside mathematics was then made by George Boole, whose overall goal was to mathematize logic.

Among others, Volker Peckhaus has shown that the British tradition of the algebra of logic was recognized in Germany with a delay of 30 years (Peckhaus 2012, 2005). In this context, the German mathematician Ernst Schröder played a key role. Schröder was not only heavily influenced by Peirce, but also by Christine Ladd-Franklin and her study of William Stanley Jevons and Hugh MacColl. Ladd-Franklin, in turn, was well acquainted with both Schröder's and Peirce's work. She reviewed Schröder's logic in *The Mind* (Ladd-Franklin 1892). In turn, it was Schröder who drew her attention to Frege's *Begriffsschrift* (Frege 1879). Ladd-Franklin, on the other hand, drew Peirce's attention to Schröder's review of Frege in the 1880 *Zeitschrift für Mathematik und Physik* (Anellis 2018). As many logicians of that time, both Ladd-Franklin and Schröder underestimated the importance and innovative aspect of Frege's ideas.

Frege became known to a wider circle of (anglophone) readers after the appearance of Bertrand Russel's *Principles of Mathematics* (Russell 1903). Emily E. Constance Jones discussed Russell's *objections* to Frege's theory in the form of an elaborated critique (Jones 1910). In her *Modern Introduction to Logic* (Stebbing 1933), Lizzie Susan Stebbing referred to both Ladd-Franklin and Jones, although she did not discuss them. But let us come back to the German-speaking female logicians.

According to Irving H. Anellis, "the conception of a Fregean revolution was further disseminated and enhanced in the mid-1920s thanks to Paul Ferdinand Linke" (Anellis 2011, 134), who came to Jena in 1907, where he taught until the end of his days. In 1946, Linke published an article entitled "Gottlob Frege als Philosoph" (Linke 1946). Linke did not present an introduction to Frege's philosophy, but interpreted Frege through the glasses of the Brentano-school. A much more challenging and worth reading introduction was offered 13 years earlier by Wilma Papst. Her book has the same title: *Frege als Philosoph* (Papst 1933).

Papst not only presents an overview of Frege's philosophy, but discusses its ontological premises and epistemological implications in detail and contextualizes the results within the historical background, by comparing Frege with Husserl, Bolzano, and Russell, just to give a few examples. In an original way, she combines her interpretation with Hermann Weyl's reflections on the relationship between formal symbolism and the construction of the real world and tries to build a bridge between logicism and formalism via Gestalt theory. Linke did not refer to her contribution, but he was probably familiar with her work, at least since 1954. In this year, Günter Mortan, who was an assistant of Linke in Jena, finished his dissertation *Gottlob Freges philosophische Bedeutung* (Mortan 1954), in which he made several references to Papst. Linke was the first referee and supervisor of Mortan's doctoral thesis. The second referee was the Neo-Kantian Hermann Johannsen, who became one of the most important representatives of modern logic in the DDR after the Second World War.

One of Johannsen's early students was Editha Krenz, who received her doctoral degree in 1942 with a work on Frege's concept of number at the University of Vienna (Krenz 1942). In her curriculum vitae, she mentions Johannsen as the one who advised her to work on Frege, when she was studying in Jena. Krenz's work was an important contribution to Frege's

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philosophy of arithmetic. Influenced by Friedrich Waismann's *Introduction to Mathematical Thinking: The Formation of Concepts in Modern Mathematics* (Waismann 1936), she also reflected on foundational issues in the light of Gödel, Gentzen and Skolem after and beyond Frege.

Particularly worth mentioning are the contributions of female logicians within the Vienna Circle (Hilda Geiringer v. Mises, Olga Hahn (Neurath), Rose Rand, Amalia Rosenblüth et al.) and the Lwów–Warsaw school (Eugenia Blaustein, Daniela Gromska, Janina Hosiasson-Lindenbaum, Maria Kokoszyńska-Lutmanowa, Janina Kotarbińska et al.), which cannot be explicitly addressed here. It remains to be desired that logic experts recognize the relevance of the task to investigate, evaluate and interpret the works of female logicians. At the very least, I hope that my short commentary has demonstrated that women have highly contributed to the history of modern logic.

Much harder to answer is the question of how a problem-orientated historiography of logic can be combined with the demands of a feminist history and philosophy of science. Karin Beiküfner has given a remarkable approach that should be pursued and expanded.

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