

**Patterns of Thought and Number:
A History of Mathematical Logic in Late Republican and Early Socialist China (1930–1960)
(Jan Vrhovski)**

REPORT

The present dissertation is a solid piece of scholarship. It clearly shows that Mr. Vrhovski has spent a significant amount of time and effort thoroughly researching and gathering a massive amount of information on the topic. An equal amount of time has evidently been invested into the coherent, systematic organization and pertinent historical, socio-cultural and intellectual contextualization of the information gathered. Mr. Vrhovski's dissertation provides an exhaustive, well-structured organic overview of the development of mathematical logic, both as a concept and as an academic discipline, across the 19th and 20th century, with a special focus on the decades comprised between the 1920s and the period around the May Fourth Movement, with the first formulations of an idea of mathematical logic, originally imported from foreign scientific and intellectual discourse; the 1930s and the further development of the concept of mathematical logic as an object of thought of an autochthonous original philosophical discussion at philosophy departments at major universities in China; and finally the transition of mathematical logic from the field of philosophy to that of mathematics as a direct consequence of dramatic ideological and ongoing socio-political changes in the historical conjuncture of the years following the Revolution and the foundation of the People's Republic of China, and the concomitant acquisition of the status of academic discipline and its establishment in mathematical departments as a fundamental subject of the curricula in the period between the 1950s and 1960s.

Mr. Vrhovski's endeavor is especially praiseworthy for the minutious work of synthesis that he has carried out, considering the nature of the primary and secondary source materials used, as the information preserved in especially Chinese secondary literature most often needs to be carefully and painstakingly collated from several different texts, each providing one piece of the puzzle, and then integrated into a coherent whole in order to produce a complete and exhaustive and rigorous scientific account. He is evidently familiar with all the different facets and stages of evolution of the topic at issue, with the diachronic and synchronic development of the discourse on mathematical logic across the 19th and 20th century, and especially in its transition and evolution from its first conceptualization as a notion or idea within the field of philosophy and its later gradual shift to the field of mathematics on one side, and the history of

its establishment as an eventually well-respected and most relevant academic discipline within the field of mathematics with practical application in electronic computing on the other side.

Mr. Vrhovski has acquired a remarkably wide knowledge and a comprehensive grasp of the Chinese intellectual landscape of an intricate period of time in the history of the Republic first, and the People's Republic thereafter, characterized by a politically complex situation in which several different aspects of political ideology and intellectual trends are closely and inextricably entangled, and especially after 1949, a strict ideological control is systematically exerted over academic and scientific research at large that determines not only the disciplines, but also the specific research areas and topics that were considered ideologically acceptable and worth pursuing.

One of the most interesting issues addressed in Mr. Vrhovski's dissertation that is relevant and complementary to the development of mathematical logic through the decades is the terminological changes of scientific terms and their evolution, adjustment and gradual process of standardisation during the nationalistic period, and the differences and discrepancies existing between the pre-existing philosophical terminology and the slowly developing (and still far from being standardised) mathematical terminology. It is especially interesting to see how it is possible to identify traces of the effect exercised by broader cultural phenomena and intellectual trends as reflected into such semantic shifts and terminological changes happening in this period, such as for instance the cultural essentialization resulting from the strive for a re-traditionalisation of Chinese terms based on Chinese traditional philosophical terms promoted and strongly supported by Sun Yat-sen. Under certain aspects, the claim at the basis of this attempt that the principles and concepts expressed by mathematical logic should be universal and beyond any potential cultural divide, hence expressing them in a terminology mutuated from the Classical Chinese tradition should not have made them any less intelligible to non-Chinese, is of particular interest and unexpectedly "modern" as it resonates with certain contemporary ongoing intellectual debates. Tables for consultation providing a comparison of the terminology in use that was included in the glossary *Philosophical Terms* are provided (pp. 63–67), showing the evolution of the technical terminology and the different nuances and facets of meanings highlighted by the different and potentially competing terms.

A substantial added value to the present dissertation is provided by the fact that Mr. Vrhovski is evidently also competent in mathematics, as it can easily be evinced since the very beginning from the familiarity and ease with which he navigates the subject and handles most complex theories in the field of logic studies in the West, giving exact and pertinent references to highly complex theoretical systems and most cutting-edge contemporary trends and theories. He

gives proof of his command of mathematics and logic – besides his knowledge about the history of and the main theories in the fields of mathematics and logic – especially in the section specifically dedicated to a thorough, systematic analysis of the scientific contributions of Hu Shihua (esp. 219–221). By combining his expertise in both disciplines, Mr. Vrhovski is capable of producing a much richer, more exhaustive and reliable informed account of the history of mathematical logic in China, highlighting the main points of contact and divergence existing between theories and approaches that developed in the West and in the Soviet Union. He successfully disentangles the different layers of both the intellectual and ideological influence exercised by these two foreign powers through their scientific achievements during different time periods and at different stages of the developmental process of mathematical logic in China. Mr. Vrhovski is also able to delineate an even more complete picture of the ideological, philosophical and scientific influence exercised especially by the Soviet Union in the 1950s on the history and the evolution of Chinese mathematical logic during the apex of cultural exchanges between the two countries before the Sino-Soviet split. He thereby shows how and insofar Chinese mathematical logic and its ideological status diverged to a large extent from the Soviet case. Thanks to his knowledge of Russian that allows him to access original primary and secondary sources, he explores in depth the different ideological struggles that characterized especially the complex history of mathematical logic in the Soviet Union that nowadays remain instead almost inaccessible to most scholars. Making the content of such sources more easily and broadly accessible to the scientific community through this account is already to be considered as a major service to the field.

Mr. Vrhovski is especially aware of and knowledgeable in the details about the different scientific contributions provided to the academic and intellectual discourse revolving around mathematical logic through its different stages of development by all major Chinese intellectuals and scholars of the time employed at main academic institutions throughout the country. He carefully reconstructs and provides integrated accounts of their personal and education background, and especially their academic and intellectual influences, their endeavors, more relevant publications and scientific achievements, pertinently contextualizing them against and within the contemporary socio-historical, disciplinary and cultural background. By recounting the lives and deeds of these scholars, Mr. Vrhovski has reconstructed a narrative and produced a proper intellectual history – and to my knowledge, the first in a Western language – of mathematical logic in China from scratch. The thesis represents an original and most needed contribution that fills in a gap in the existing scholarship on the history of science and especially the history of logic in China. It also provides an invaluable contribution through its screening of the contents of the Chinese and Russian

secondary scholarship on mathematical logic and its history, especially within the context of a potential broader intellectual exchange across and among experts of different disciplines, as the materials he has been working on would otherwise have remained largely – if not almost completely –inaccessible for any scholar expert in mathematics that were not at the same time competent in Modern Chinese and/or Russian.

The thesis clearly shows that the author has a very solid command of the Modern Chinese language and is widely knowledgeable about the Chinese secondary scholarship on the topic. He has carried out extensive research on this sources and read a significant amount of the scholarship available in Chinese on mathematics and mathematical logic and their development in the last century. However, this apparently does not seem to be the case when it comes to the secondary scholarship on the history of science and the history of mathematics in Western languages. While there might not already exist an equally systematic comparable study and reconstruction of the history of mathematical logic in China, and the Western secondary scholarship available that might potentially be referring to this issue might not be as exhaustive and informative on this topic in particular, it still for sure remains most useful and reliable when dealing with the broader topic of the history of mathematics and the history of science in China tout court. As mentioned above, Mr. Vrhovski abundantly demonstrates mastery of the secondary scholarship in Chinese on the topic, which often requires a scholar to integrate several different partial accounts to produce one coherent narrative due to the fact that information is often scattered, incomplete and references are not always informative. Also, these sources are typically available only in the original language. However, I would have expected that a similar dedication and degree of scrutiny had been devoted as well to the analysis of the secondary literature on the topic in Western languages, including the work of scholars such as, for instance, Thierry Lucas, Fred Rieman, Andrea Bréard, Karine Chemla, Catherine Jami, just to quote a few. For instance, I am somewhat surprised that, when discussing earliest attempts at providing an overview of the development of mathematical logic in China and talking about Western scholarship of the topic, only a fairly late Ph.D. thesis by a Chinese scholar is mentioned (p. 11). What about all the Western experts on logic and mathematics? It sounds somewhat unlikely that no one among the renown Western experts in the field of the history of Chinese science and mathematics has ever even mentioned mathematical logic and its struggles to be recognized as a proper academic discipline in the Chinese academic system of the time. If this is indeed the case, then it should be adequately mentioned in the thesis.

One of the limits of the present thesis is, to a certain extent, accessibility. As it stands, the current work is indeed a remarkable piece of scholarship providing a detailed and exhaustive reconstruction of the evolution of mathematical logic in China across the 19th and 20th century. However, it remains hardly approachable for someone who does not already have a solid preliminary knowledge of the language and the main theories of Western logic and mathematics in the 20th century, as for instance no explanation is provided of mathematical and logic theorems in the footnotes about, for instance Gödel's incompleteness theorem or Carnap logic, or Cantorian set theory, just to quote a few. To a certain extent, and especially in the first chapter, the thesis seems to be written predominantly from the perspective of the mathematician rather than the sinologist, while the other chapters seem to be more balanced, or in any case to contain a significant amount of philosophico-theoretical contextualization and a stronger focus on ideological and philosophical issues that are tendentially more familiar to the sinological reader. While it clearly goes beyond the scope of the present thesis to provide a compendium of major theorems and theories in modern and contemporary logic and mathematics, I believe it would significantly improve the readability of the first chapter in particular to include either a glossary with brief explanations of the general tenets of such theories in an appendix, or in any case to include at least some basic information along the lines of the very useful note 128 at p. 148 on Robinson, which is undoubtedly helpful and clear despite being concise.

Besides this suggestion concerning the basic explanation of main mathematical and logic theories cited, my main pieces of advice are as follows:

- The work would benefit from English copy-editing. Overall, there is a significant number of imprecisions or minor mistakes, almost all trivial and evidently due to rush rather than to any actual lack of knowledge. While they do not substantially affect the comprehension of the thesis per se, they somehow reflect poorly on what is instead a fine scholarly work. I am providing a few selected suggestions for improvement and corrections here below. These do not constitute a criticism on the content or quality of the thesis per se.
- Somehow the first chapter seems to be more dense and is harder to read due to the large amount of biographical details provided. It is also the chapter that shows the higher amount of imprecisions, which seems to suggest that it was possibly composed at the end. I would recommend if possible to somehow eliminate less relevant details concerning the lives of the first Chinese mathematical logicians, or at least to provide

these details in footnotes rather than to concentrate them all in the main body of the text.

- The long digression on the philosophy of Engels and Lenin and their understanding of dialectical materialism and dialectics of nature at the beginning of Chapter 3 is useful to a certain extent, but is far too long. I would still provide this background information that is helpful for the reader who might not necessarily be familiar with these concepts to understand and better contextualize the Chinese reception, understanding and original re-elaboration of these theories, especially in consideration of the influence their different interpretation has exercised on the acceptance of mathematical logic in the PRC. Similarly, also the last section on Hu Shihua represents a rather long digression that could be shortened without affecting the overall structure of the thesis.
- I would have liked to see a more engaging problematization and argumentation of the issues treated directly in the different sub-sections of the thesis, rather than just in the Conclusions at the end of each section. The most original and interesting ideas and contributions to the current discussion are indeed presented only at the end of each section, leaving the reader quite puzzled as the other sections seem to be at times rather dry lists of data, especially in the first chapter. I would recommend to progressively integrate the ideas expressed in the conclusions into the individual sub-sections, so that the reason why certain details are indeed relevant and need to be cited would become immediately apparent.

Finally, it is my opinion Mr. has exhaustively demonstrated that he possesses the academic skills and maturity, the necessary scientific rigour, and the intellectual acumen that characterizes a scholar. His Ph.D. dissertation fully satisfies all the criteria and the required standards of a proper doctoral thesis, both formally and contentwise, to justify the awards of a Ph.D.

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Suggested revisions

- p. 12: ideological fundamentals = foundations
- p. 13: advances = advancements
- p. 17: thigs = things
- p. 23: Carnap's 'logistics'
- p. 30: the hermetic domain of philosophy = "hermetic" in which sense?
Note 47: Zhu produced a distilled translation = condensed?
- p. 47: jiben jiehe **zhi fa** 基本結合之法
- p. 72: emersed = immersed
- p. 122: Engels' and Lenin's of mathematics = something missing here, accounts?
- p. 133: when the first number of the *Journal of Studies in Dialectics of Nature (JSDN)* **was published** (something missing here)
- p. 139: and the antagonistic = I am not sure I understand what "antagonistic" refers to here
- p. 144: 數理邏輯是用改重視的一門科學 = wrong characters, 是應該重視.....
- p. 154: "blow of the shoulder pole" = I do not understand what it is meant or referred to with this expression
- p. 161: note 138: years gained (**something missing here, "momentum"?)** and became more and more explicitly stated
數學思想史禮記 = pinyin missing, shuxue sixiangshi liji? Is 禮記 correct?
- p. 167: Hu the field of foundations = verb missing here, "defined"?
- p. 171: Hu derives from areas of its application as the main "Marxist" points of departure in accordance with which a new inner classification of the discipline is developed = there seems to be something missing in this sentence
- p. 175: "Sinization" = "sinicization"
- p. 189: Xu Lizhi's 徐利治
- p. 200: 一種邏輯電路演算的構作 = missing characters 初步
- p. 219: zucheng guiyze 組成規則