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# Cultures of Mathematics and Logic

Selected Papers from the Conference in Guangzhou, China, November 9-12, 2012

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# Preface

Mathematics and formal reasoning are fundamental building blocks of knowledge, essential for science, technology, policy-making, and risk-management. Mathematical practice is a rich phenomenon of human activity, with subtle differences between various cultures. Here, the word "culture" can refer to national cultures, but also cultural differences in different historical periods, in different strata of a given society, or in different social settings.

And yet, the public perception of mathematics is that of an apersonal subject with little or no human interaction, based on a false picture of a science of pure thought and deduction, with almost no interaction or visible activity.

In a move away from these traditionalist positions, philosophers and social scientists have recently become more interested in studying mathematical and logical practice, or more accurately, the differences between mathematical and logical practices. The conference *Cultures of Mathematics and Logic* held in Guangzhou, China, was the third in a series of interdisciplinary, international conferences that strive to bring together researchers from different fields and different backgrounds for in-depth discussions about the role and impact of culture(s) on the practice of the formal sciences of mathematics and logic. The community meeting at these conferences consists of philosophers of mathematics, historians of mathematics, sociologists of mathematics, anthropologists, cognitive scientists, and researchers in mathematics education. Previous meetings of this series were *Mathematics as Culture and Practice*, held in Bielefeld, Germany (May 2010), and *Mathematics as Culture and Practice II*, held in Greifswald, Germany (December 2011). While members of our community believe that an ambient (non-mathematical) culture affects mathematical practices, so that there are differences between national styles of mathematics, these differences can be difficult to observe and isolate, especially when the ambient cultures are close to each other. It could be expected that these differences become more pronounced if the ambient cultures differ more substantially; given the dominance of Western cultural influences on mathematics and logic, the organisers of this conference felt that it would be appropriate to have the next meeting in a country with a strong and different ambient cultural tradition such as China. Naturally, discussions of Chinese mathematics became an important topic at the conference. Based on the same idea, the follow-up conference *Cultures of Mathematics IV* took place on 22–25 March 2015 in New Delhi, India.

The Guangzhou conference took place from 9 to 12 November 2012, at the campus of one of the sponsoring institutions, Sun Yat-Sen University. It was organized jointly by Shier Ju (Guangzhou), Benedikt Löwe (Amsterdam and Hamburg), Thomas Müller (then Utrecht, now Konstanz), and Yun Xie (Guangzhou). The programme committee consisted of Mihir Chakraborty (Kolkata), Shuchun Guo (Beijing), Joachim Kurtz (Heidelberg), Brendan Larvor (Hatfield), Benedikt Löwe, Martina Merz (Luzern), Thomas Müller, Dirk Schlimm (Montréal QC), and Shier Ju.

For the multi-disciplinary community behind these meetings, the notion of "practices and cultures" is at the same time central and underdetermined, and two of the papers in this volume can be seen as a discussion of our community and its aims. The article *What are mathematical cultures?* by Brendan Larvor serves as a discussion of what we might mean by *cultures* in this context; at the same time, it provides an overview of the activities and publications of our community during the last decade, which to a large extent happened under the umbrella of the *Philosophy of Mathematical Practice* movement. That the discipline of philosophy plays such an important role for our community can come as a surprise to some; the scope of our field is explored in Benedikt Löwe's *Philosophy or not? The study of cultures and practices of mathematics* where he argues that our field forms a multi-disciplinary community and discusses the role of philosophy for this community as a whole. The reader is invited to start with the papers by Larvor and Löwe to get an overview of the overall aims and scope of the community that is behind the Guangzhou conference. The talks at the Guangzhou conference took place within the framework described in these two papers. The following list documents all talks invited or accepted for presentation at our conference, including those that had to be cancelled due to various reasons:

***Invited Speakers***

**Andrea Bender.** Numeration systems as cultural tools

**Karine Chemla.** Practices of abstraction as features of a mathematical culture

**Shirong Guo.** The reasoning and its logical structure in traditional Chinese mathematics

**Juan Pablo Mejía Ramos.** Reading mathematics: Empirical research on expert mathematical practice

**Reviel Netz.** Mathematical communities in Greek antiquity

**Zhaoshi Zeng and Gang Wang.** Study of Chinese logic from the perspective of the General Argumentation Theory

***Contributed talks***

**Mihir Chakraborty and Smita Sirker.** Some aspects of mathematical pluralism

**Amita Chatterjee.** Logical subcultures in the Classical Indian theoretical tradition

**Karen François.** The cultural turn within the research field of mathematics education

**Yang He and Yanjin Chen.** On Gongsun Long's methods of argumentation
**Albrecht Heeffer.** From tables to induction in Abbaco mathematical culture
**Peter Koepke.** Formal mathematics and mathematical practices
**Joachim Kurtz.** De-modernizing the history of Chinese logic
**Brendan Larvor.** The *Mathematical Cultures* research network
**Baptiste Mélès.** Programming languages for pre-mechanical calculating tools
**Thomas Müller.** Is there such a thing as philosophical logic?
**Ranjit Nair.** Philosophies of mathematics, logic and language: East and West
**Markus Pantsar.** Philosophy of mathematics in different fields
**Stig Andur Pedersen.** Mathematics in engineering and science
**Josipa Petrunic.** Revolutions and epistemic cultures: The case of Hamilton's quaternions as an epistemic shift and a mathematical revolution
**Mario Piazza, Gabriele Pulcini, and Nevia Dolcini.** Patterns of mathematical cognition: The prototypical proof
**Dagmar Provijn.** Much reasoning, many logics: on dynamics and heuristics in reasoning
**Johannes Wietzke.** The desire for knowledge in the Greek exact sciences
**Jia-Ming Ying.** The style of argumentation in emperor Kangxi's mathematical compendium and its influence on Korean mathematics
**Yijie Zhang.** Liu Hui's inference in *The Nine Chapters on the Mathematical Procedures*: A preliminary inquiry
**Dahai Zou.** The foundations of the reasoning in the demonstration of Liu Hui's principle

The conference was funded jointly by the Institute of Logic and Cognition, Sun Yat-Sen University, China, the Department of Philosophy at Utrecht University, The Netherlands, and the Institute for Logic, Language and Computation at the University of Amsterdam, The Netherlands. We should like to thank especially the local organizational team at Guangzhou, led by Ju Shier and Yun Xie, who provided a welcoming atmosphere and an efficient local organization. We are also grateful for the work of our programme committee and for the diligent work of the many referees that helped with the time-consuming task of selecting the best among submitted papers. The editors insisted on the highest standards of journal refereeing for all papers. They accepted only those that met the criterion of scientific excellence in order to produce a high-quality volume that reflects the topics discussed at the conference.

December 2015 S.J., B.L., T.M., Y.X.

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