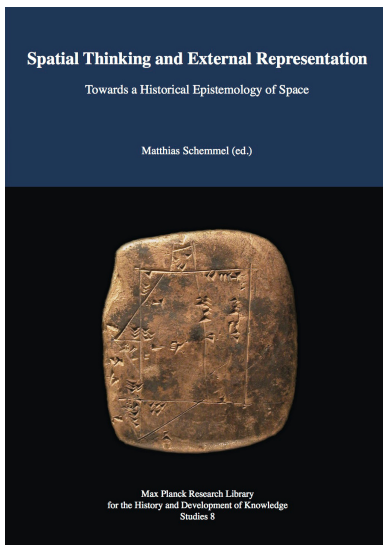


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Preface



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Spatial Thinking and External Representation

Towards a Historical Epistemology of Space

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Spatial Thinking and External Representation
Towards a Historical Epistemology of Space

Matthias Schemmel (ed.)

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Surveyor's field map, Ur III period (twenty-first century BCE), MVN 10, 214.
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To the memory of Peter Damerow (1939–2011)

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Preface

Spatial thinking plays a central role in the life of individuals as well as whole societies. It ranges from everyday orientation in our living environment to the social organization of place and space, and the structuring of a huge corpus of experiential knowledge by means of theoretical concepts in modern science. Spatial knowledge thereby takes on different forms in different contexts, and it does so depending on the spatial experiences accounted for and the available means for its external representation. From this perspective, scientific spatial knowledge is but one form of spatial knowledge and does not represent a stratum independent of non-scientific knowledge. Science is not only based on the specific kind of knowledge expressed in theoretical texts, but essentially involves a broader knowledge base comprising all we have to know in order to master our environment, our technology as well as the specific equipment necessary to gain and validate scientific knowledge. It is part of a hierarchically structured architecture of knowledge which develops over history, just as experiences and means of representation vary over societies and history.

This volume presents and analyses manifestations of spatial thinking in various societal and historical circumstances: in the language and practices of recent non-literate societies, in the administrative institutions of early civilizations, in discursive contexts of ancient Greece and China, in early modern natural philosophy and metaphysics, and in twentieth-century physics. It discusses the historical and structural relations of the different forms of spatial knowledge and thereby attempts to address the question of the epistemic status of this knowledge. The exemplary cases discussed in the different chapters give no exhaustive account of spatial knowledge in human history, but are chosen to highlight important aspects of the cultural development of spatial knowledge. There are various other important topics (e.g. the history of cartography or the history of perspective) that could further contribute to the project of a historical epistemology of space as presented in this book.

This book presents results of the working group *The Historical Epistemology of Space*, conducted jointly by the Max Planck Institute for the History of Science in Berlin and the Humboldt University of Berlin in the framework of the project cluster TOPOI in the period 2008–2012. All contributions are authored by members of the group, its fellows and close collaborators. As the title of the book indicates, a conceptual focus of the group's research was external, or material, knowledge representations, by means of which knowledge is transmitted from one generation to the next, but also between cultures, thus producing continuity in the historical development of thinking. Since the means of knowledge representation at the same time serve as tools for thinking, they propel the interaction of experience and reflection in the historical development of spatial knowledge, a topic recurring in the various contexts presented in the different chapters of this book.

The book starts with a survey of the overall topic, *the historical epistemology of space*, specifying structures of spatial knowledge under different historical and cultural conditions and characterizing their epistemic status (Chapter 1). In the following chapters, different

forms of spatial knowledge are presented through exemplary studies, which constituted the core of the group's research.

Spatial concepts in non-literate societies are discussed by comparing spatial languages and practices in Eipo and Dene Chipewyan, two independent, recent non-literate societies (Chapter 2). The analysis of these two societies is largely based on fieldwork that had previously been carried out by the authors themselves. Questions of the universality and culture-dependence of spatial thinking in societies that codify spatial knowledge almost exclusively by means of spoken language and joint action are addressed.

The impact of notation systems on collectively shared spatial knowledge is discussed with regard to the emergence of the systematic use of signs conveying arithmetical and lexical meaning as a means of knowledge representation (Chapter 3). Such changes took place in different early civilizations and the chapter pursues the development in Mesopotamia from the practical knowledge of surveyors at the beginning of the third millennium BCE to Babylonian geometry in the mid-second millennium BCE.

Theoretical reflections on elementary actions and instrumental practices are discussed using the example of spatial, temporal and material concepts documented in the *Mohist Canon*, a theoretical text from Warring States China, ca. 300 BCE (Chapter 4). In particular, the study allows comparative questions to be addressed concerning the independent emergence of theoretical knowledge traditions in ancient Greece and China.

The relation between *cosmology and epistemology* is studied by comparing the different approaches to arguing for the centrality of the earth of the two major classical authorities on cosmology, Aristotle and Ptolemy, and by discussing aspects of their reception up to early modern times (Chapter 5). It is shown how the focus on different parts of experiential knowledge and the use of different means of knowledge representation leads to divergent theoretical constructions in arguing for the same result: Aristotle's approach proceeds from the physical explanation of terrestrial phenomena to the cosmological realm, while Ptolemy follows the opposite direction, starting from mathematical-cosmological considerations and astronomical observations.

Concepts of *space and matter in early modern science* are discussed as a case of theoretical reflection in the context of early modern natural philosophy and mathematics (Chapter 6). Focusing on attempts to distinguish matter from space by assuming that its essential property is impenetrability, the chapter is particularly concerned with an analysis of the empirical foundations of metaphysical concept and system building.

Experience and representation in disciplinarily structured science are discussed by delineating the fundamental changes in the concepts of space and time brought about by the advanced formalism of twentieth-century physics, which enabled the integration of a growing corpus of experiential knowledge (Chapter 7). In particular the chapter addresses the question of why certain parts of experiential knowledge had an impact on concepts of space and time, while other parts did not.

This work was supported by the TOPOI project cluster and the Max Planck Institute for the History of Science in Berlin. The book is dedicated to the memory of Peter Damerow (1939–2011), whose support was crucial in shaping the project.

Matthias Schemmel
Berlin, March 2016