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Preface

This is the fourth volume in a series of books dedicated to basic research in spatial cognition. Spatial cognition is a field that investigates the connection between the physical spatial world and the mental world. Philosophers and researchers have proposed various views concerning the relation between the physical and the mental worlds: Plato considered pure concepts of thought as separate from their physical manifestations while Aristotle considered the physical and the mental realms as two aspects of the same substance. Descartes, a dualist, discussed the interaction between body and soul through an interface organ and thus introduced a functional view that presented a challenge for the natural sciences and the humanities. In modern psychology, the relation between the physical and the cognitive space has been investigated using thorough experiments, and in artificial intelligence we have seen views as diverse as 'problems can be solved on a representation of the world' and 'a representation of the world is not necessary.'

Today's spatial cognition work establishes a correspondence between the mental and the physical worlds by studying and exploiting their interaction; it investigates how mental space and spatial "reality" join together in understanding the world and in interacting with it. The physical and representational aspects are equally important in this work. Almost all topics of cognitive science manifest themselves in spatial cognition. A special feature of spatial cognition is that the spatial dimensions in the physical world are accessible to most of the human sensory systems and to a great variety of technical sensors and measuring approaches that provide information about the spatial environment. Thus, on one hand, mental phenomena can be investigated using methods of the natural sciences and using experimental methods from psychology. On the other hand, they can be explored through the behavior of artificial systems in space, through formal methods for dealing with spatial knowledge, and through computational investigations. Ideally, these different approaches are strongly interconnected.

After almost 20 years of research dedicated to spatial language, conceptualization of spatial relations, representation of spatial knowledge, spatial and spatio-temporal reasoning, spatial reference systems, cultural differences in conceptualizing space, spatial memory, neural mechanisms of spatial cognition, localization of spatial functions in the brain, spatial attention, and robot navigation, spatial cognition has become a well-established interdisciplinary research field within the disciplines of cognitive science. Structured cross-disciplinary research initiatives in Germany, Europe, and in the USA were instrumental in bringing different research communities together through workshops and conferences in this area.

In 2002, the German Academic Exchange Service (DAAD) provided funds in the framework of the Future Investment Program to establish an *International Quality Network on Spatial Cognition* (IQN) that connects major research teams in the field

worldwide and to provide an infrastructure for scientific exchange and training. In 2003, the Deutsche Forschungsgemeinschaft (DFG) established the *Transregional Collaborative Research Center on Spatial Cognition* (SFB/TR 8) at the Universities of Bremen and Freiburg to carry out basic research on the integration and specialization of approaches to spatial reasoning, spatial action, and spatial interaction.

The SFB/TR 8 organized the international conference *Spatial Cognition 2004* held in October 2004 at the abbey Frauenwörth on the island of Frauenchiemsee in Bavaria, Germany. Fifty contributions were submitted in response to the conference call. After a thorough peer-review process carried out by the international program committee of the conference, 27 contributions were selected for oral presentation and for publication in this proceedings volume; 14 contributions on work in progress were selected for poster presentation.

This volume presents contributions by 67 authors from 10 countries on 4 continents on a large spectrum of interdisciplinary work on descriptions of space, on spatial mental models and maps, on spatio-temporal representation and reasoning, on route directions, wayfinding in natural and virtual environments, and spatial behavior, and on robot mapping and piloting.

Many people contributed to the success of the *Spatial Cognition 2004* conference. First of all, we thank the members of the review committee of the SFB/TR 8 Armin Cremers, Rüdiger Dillmann, Max Egenhofer, Ulrich Furbach, Werner Kuhn, Elke van der Meer, Michael Richter, Helge Ritter, Ipke Wachsmuth, Wolfgang Wahlster, Jürgen Wehland, and Martin Wirsing, as well as the program officers Gerit Sonntag and Bettina Zirpel of the Deutsche Forschungsgemeinschaft for their excellent guidance and support. We thank all authors for their careful work and for observing our tight deadlines in an exemplary fashion. We thank the reviewers for their careful work, their excellent suggestions, and their speedy reviews. We also thank the members of our support staff Eva Räthe, Dagmar Sonntag, Marion Stubbemann, and Sandra Budde for their competent and smooth organization of the conference and for editorial support; we thank Frank Dylla and Dominik Engel for maintaining the conference management system. Special thanks are due to Ms. Scholastica McQueen for her friendly reception at the abbey Frauenwörth and for her dedicated assistance. Finally, we thank Alfred Hofmann and his staff at Springer for their continuing support of our book series.

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