Preface

Spatial cognition is concerned with the ways humans, animals, or machines think about real or abstract space and also with the ways spatial structures can be used for reasoning. Thus, space is considered both, as an *object* of cognition and as a *means* of cognition. Spatial cognition is an interdisciplinary research area involving approaches from artificial intelligence, cognitive psychology, geography, mathematics, biology, design, theoretical computer science, architecture, and philosophy. Research on spatial cognition has progressed rapidly during the past few years. The disciplines contributing to the field have moved closer together and begin to speak a common language. They have found ways of merging the research results obtained through different approaches. This allows for developing more sophisticated hybrid approaches that overcome intrinsic limitations of the individual disciplines.

Research on spatial cognition has drawn increased attention in recent years for at least three different reasons: (1) basic research dimension: there is a growing awareness of the importance of spatial cognitive abilities in biological systems, specifically with respect to perception and action, to the organization of memory, and to understanding and producing natural language; (2) computational dimension: spatial representations and spatial inference may provide suitable limitations to enhance the computational efficiency for a large and relevant class of problems; (3) application dimension: a good understanding of spatial processes is essential for a wide variety of challenging application areas including Geographic Information Systems (GIS), pedestrian and vehicle navigation aids, autonomous robots, smart graphics, medical surgery, information retrieval, virtual reality, Internet navigation, and human-computer interfaces.

This is the second volume published in the framework of the Spatial Cognition Priority Program. It augments the results presented in Freksa et al. 1998. The interdisciplinary research program (www.spatial-cognition.de) was established by the Deutsche Forschungsgemeinschaft in 1996. It consists of 16 research projects at 13 research institutions throughout Germany. Besides carrying out research in individual projects and joint research between projects, the Spatial Cognition Priority Program organizes 'topical colloquia', partly with international participation. A colloquium on *Types of spatial knowledge* was held in Göttingen in May 1997; a colloquium on *Spatial cognition and soft computing* was held in Hamburg in June 1997; a colloquium on *Qualitative and metric approaches to spatial inference and motion analysis* was held in Berlin in June 1997; a colloquium on *Space and action* was held in Ohlstadt in December 1997; a colloquium on *Route and survey knowledge* was held in Bremen in February 1998; a colloquium on the *Representation of motion* was held in Munich in October 1998; a colloquium on *Spatial inference* was held in Freiburg in February 1999; a colloquium on *Systems of reference for spatial knowledge* was held in Hamburg in April 1999; a colloquium on *Spatial cognition in real and virtual environments* was held in Tübingen in April 1999; and a colloquium on *Maps*

and diagrammatic representations of the environment was held in Hamburg in August 1999.

The volume contains 28 articles and is structured into five sections: The section *Maps and diagrams* consists to a large extent of contributions to the international colloquium on *Maps and diagrammatic representations of the environment.* The work presented in the section *Motion and spatial reference* was discussed at the colloquium on the *Representation of motion* or at the colloquium on *Systems of reference for spatial knowledge.* The section *Spatial relations and spatial inference* draws largely from contributions to the colloquium on *Spatial inference.* Most of the work published in the section *Navigation in real and virtual systems* was first presented at the international colloquium on *Spatial cognition in real and virtual environments.* Some of the work in the section *Spatial memory* had been discussed at the colloquium on *Route and survey knowledge.* All contributions underwent a thorough reviewing procedure. The articles reflect the increased cooperation among the researchers in the area of spatial cognition.

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