# Contents

#### Preface / vii

# **Animation and Interactivity**

The Influence of Spatial Ability on the Use of Dynamic, Interactive Animation in a Spatial Problem-Solving Task / 1

Cheryl A. Cohen

Towards an Understanding of Geovisualization with Dynamic Displays: Issues and Prospects / 6 Sara Irina Fabrikant

Computerized Representations of 3D Structure: How Spatial Comprehension and Patterns of Interactivity Differ among Learners / 12 Madeleine Keehner and Peter Khooshabeh

Dynamic Aspects of Spatial Information in Air Traffic Controller Displays / 18
Paul U. Lee and Alexander Klippel

Learning Interaction Patterns Using Diagrams Varying in Level and Type of Interactivity / 24 Nuno Otero, Yvonne Rogers, and Benedict du Boulay

### **Problems for Spatial Assistance Research**

The Landmark Spider: Representing Landmark Knowledge for Wayfinding Tasks / 30

David Caduff and Sabine Timpf

Maps beyond Diagrams: Real-World Spatial Orientation / 36 Clare Davies

Schematic vs. Topographic Maps in Pedestrian Navigation: How Much Map Detail is Necessary to Support Wayfinding / 41 Georg Gartner and Verena Radoczky

Towards Cognitively Adequate Interaction for Mental Model-Based Spatio-Temporal Assistance / 48 Inessa Seifert

> A Qualitative Model for Natural Language Communication about Vehicle Traffic / 52 H. Joe Steinhauer

# **Tools for Spatial Assistance**

Toward Intelligent Drawing Constraints / 58 Ronald W. Ferguson, Neil Cutshaw, and Huzaifa Zafar Graphics for Patient-Tailored Information in Clinical Genetics / 64
Nancy L. Green

Similarity of Spatial Configurations in Interactive Layout / 67

Cornelius Hagen

The Use of Digital Concept Maps as Cognitive Tools for Managing Knowledge and Knowledge Resources / 73 Sigmar-Olaf Tergan

# Mental and External Diagrams

Show Me How You Act on a Diagram and I'll Tell You What You Think (or: Spatial Structures as Organizing Schemes in Collaborative Human-Computer Reasoning) / 77

What Makes a Bunch of Marks a Diagrammatic Representation, and Another Bunch a Sentential Representation? / 83

B. Chandrasekaran

The Cognitive Conceptual Approach as a Leitmotif for Map Design / 90 A. Klippel, P. U. Lee, S. Fabrikant, D. R. Montello, and J. Bateman

Stop Using Introspection to Gather Data for the Design of Computational Modeling and Spatial Assistance / 96 Markus Knauff

> Semantics of Simple Arrow Diagrams / 101 Yohei Kurata and Max J. Egenhofer

Explanations in Diagram, Word, and Gesture / 105
Barbara Tversky, Sandra Lozano, Julie Heiser,
Paul Lee, and Marie-Paule Daniel

## **Diagrams in Problem Solving**

A Diagrammatic Reasoning Architecture: Design, Implementation and Experiments / 108 B. Chandrasekaran, Unmesh Kurup, and Bonny Banerjee

How Representations and Strategies Influence Design Spatial Problem Solving / 114 Chun-Heng Ho and Charles M. Eastman

Visualization and Diagrammatic Reasoning during Genuine Problem Solving in Science / 121 Mike Stieff

Articulating Space through Architectural Diagrams / 127 *Georg Vrachliotis*