Transregional Collaborative Research Center Sonderforschungsbereich/Transregio

SFB/TR 8

Spatial Cognition: Reasoning – Action – Interaction

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Spatial Cognition

Spatial Cognition is concerned with the acquisition, the organization, the utilization, and the revision of knowledge about spatial environments, be it real or abstract, human or machine. Research issues range from human spatial cognition to mobile robot navigation. Numerous results have been obtained: there are theoretical results about spatial knowledge representation and spatial reasoning; there are empirically gained results from psychological experiments; and there are implementations both of specialized reasoning techniques and of computational cognitive models.

The SFB/TR 8 Spatial Cognition aims at integrating the diverse specialized computational solutions and results into a common framework of cognitive functions to deal with complex spatial tasks. The goal of the SFB/TR 8 is to investigate the cognitive foundations for human-centered spatial assistance systems.

SFB/TR 8 Spatial Cognition: Reasoning – Action - Interaction

The interdisciplinary Transregional Collaborative Research Center (Sonderforschungsbereich/Transregio) Spatial Cognition: Reasoning – Action – Interaction SFB/TR 8 is funded by the Deutsche Forschungsgemeinschaft (DFG) since the beginning of 2003. For the first funding period of 4 years, an amount of approximately € 5.5 million has been granted. The planned total duration of the SFB/TR 8 is 12 years. Currently, 11 projects are carried out at the universities of Bremen and Freiburg.

In these projects, more than 30 researchers work collaboratively, guided by 11 principal investigators (see Table 1). The research center is coordinated by Christian Freksa (Universität Bremen).

The SFB/TR 8 is structured into three research areas: *Reasoning*, *Action*, and *Interaction*. Reasoning projects are concerned with internal and external representations of space and with inference processes using these representations. Action projects are concerned with the acquisition of information from spatial environments and with actions and behavior in these environments. Interaction projects are concerned with the communication about space by means of language and maps. Table 2 gives an overview of all SFB/TR 8 projects.

Table 1: Principal investigators at Universität Bremen and Universität Freiburg.

PIs at Universität Bremen:
Dr. Thomas Barkowsky
Prof. John Bateman, Ph.D.
Dr. Kerstin Fischer
Prof. Christian Freksa, Ph.D.
Prof. Dr. Frank Kirchner
Prof. Dr. Bernd Krieg Brückner
Dr. Reinhard Moratz
Dr. Thomas Röfer
PIs at Universität Freiburg:
Prof. Dr. Wolfram Burgard
PD Dr. Markus Knauff
Prof. Dr. Bernhard Nebel

Table 2: SFB/TR 8 projects.

Research area *Reasoning*:
R1-[ImageSpace]: Mental Representations of Spatial Environments (Freksa / Barkowsky)
R2-[BackSpace]: Effects of Background Knowledge on Human Spatial Reasoning (Knauff / Nebel)
R3-[Q-Shape]: Reasoning about Paths, Shapes, and Configuration (Freksa / Moratz)
R4-[LogoSpace]: Constraint-based Reasoning in Qualitative Spatio-Temporal Calculi (Nebel / Knauff)
Research area *Action*:
A1-[RoboMap]: Maps for Robot Navigation (Röfer / Krieg-Brückner)
A2-[ThreeDSpace]: Three-Dimensional Map Construction (Burgard / Moratz / Röfer)
A3-[Multibot]: Coordinated Multi-Robot Navigation and Exploration (Burgard / Kirchner)
Research area *Interaction*:
I1-[OntoSpace]: Ontologies for Spatial Communication (Bateman / Fischer / Moratz)
I2-[MapSpace]: Wayfinding with Schematic Maps (Freksa / Knauff)
I3-[SharC]: Shared-Control Interaction via Dialogs (Krieg-Brückner / Bateman)
I4-[SPIN]: Specification for the Integration of Spatial Concepts (Krieg-Brückner)

As a unifying framework for the individual SFB/TR 8 projects, a *spatial task assistance* scenario is used.

Spatial Task Assistance

Imagine a person seeking to attend a specific meeting in an unfamiliar building complex (like a conference facility or a flexible office building). Individual assistance may be provided to this person through stationary information screens or through mobile personal digital assistants, which require keeping track of the person's actual location. Modes of assistance comprise verbal instructions and graphical communication, for instance by maps. All modes of individual spatial assistance require representations and inference processes for a cognitively adequate presentation of spatial information.

Further options for spatial task assistance might be guidance by autonomous robots or transportation by (semi-)autonomous vehicles. Figure 1 gives an idea of the issues that arise in the integration of the results of the three research areas Reasoning, Action, and Interaction to support individual spatial task assistance.

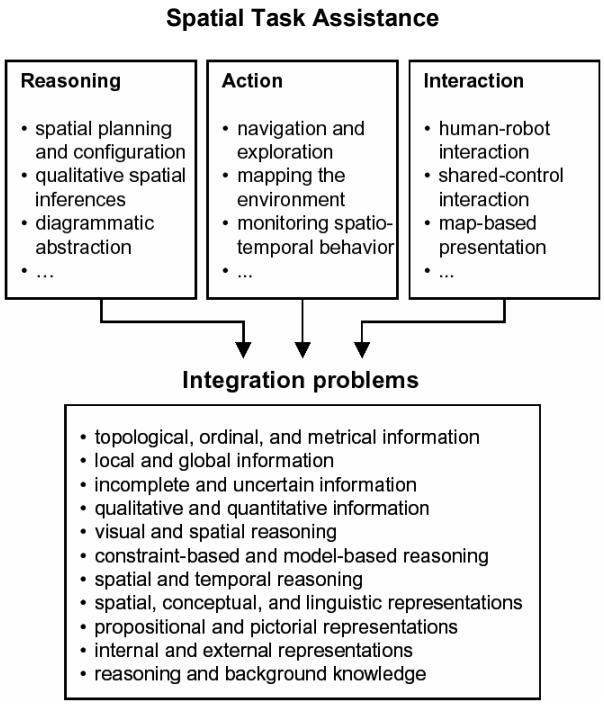

Figure 1: Integration problems and their relation to spatial assistance tasks.

Additional information about the SFB/TR 8 can be found at www.sfbtr8.uni-bremen.de.