Dear colleagues in artificial intelligence and cognitive science,

we are going to propose a symposium on

"Cognitive Shape Processing"

for the 2010 AAAI Spring Symposium Series at Stanford University (see draft of the proposal below).

Together with the symposium proposal, AAAI requests a list of researchers that express their interest in the proposed topic.Therefore, we would like to ask you to support our proposal by replying with a short notice to barkowsky@informatik.uni-bremen.de if you consider the topic worth a AAAI symposium.

Your endorsement of the symposium implies no commitment for participation.

We hope that you like the proposal and we are looking forward to your reply.
Thank you very much for your help!

The organizing committee:

Thomas Barkowsky (University of Bremen, Germany)

Sven Bertel (University of Illinois at Urbana-Champaign)

Christoph Hoelscher (University of Freiburg, Germany)

Thomas F. Shipley (Temple University)

Short description / Abstract:

Proposal for a AAAI Spring Symposium on

Cognitive Shape Processing

The goal of this symposium is to bring together researchers from artificial intelligence and the cognitive sciences to promote the understanding – from a cognitive point of view – of how shape information can be represented, retrieved, (re-)constructed, and integrated with other types of spatial information. We consider this symposium as a kick-off event that is meant to provide the grounds for identifying the most important research questions, for proposing a structuring of the scientific field, and for collecting first perspectives for potential directions of research. The long-term goal is to reach a thorough under standing of how all types of spatial knowledge interact with shape information and of how such interaction creates the unique flexibility and integrative processes which we can observe in cognitive shape processing.

Extended version:

2010 AAAI Spring Symposium Series

Proposal for a symposium on

Cognitive Shape Processing

Description

In the recent decades there has been a growing interest in understanding and computa tionally investigating how spatial information is processed in natural intelligent sys tems. The interdisciplinary field of spatial cognition, besides its basic research related motivation, also aims at improving artificial systems by transferring natural principles to technical systems, e.g. in robotics, in intelligent instruction systems or in other in telligent interactive systems.

In spatial cognition, numerous aspects of spatial knowledge are investigated, among these spatial reference systems, topological information, route knowledge, knowledge about distances and directions, etc.
For all these aspects, specific forms of representation and formalisms for reasoning about them have been devised. Common to most of the formalisms is that they usually deal with spatial knowledge on a high level of abstraction, be it that they only consider some knowledge aspects in isolation (e.g., orientation knowledge), or be it that they only deal with highly simplified spatial objects such as points or basic geometric forms.

In contrast to this abstraction, real-world problems typically deal with diverse types of spatial knowledge at the same time and they involve complex objects with meaningful and specific shapes.
Understanding mental processing of knowledge about shapes thus seems essential for understanding mental processing of spatial knowledge in real world scenarios.
Importantly, addressing shape knowledge also bears the potential of integrating diverse aspects of spatial knowledge processing since all types of spatial knowledge are affected by shape. So, on the one hand, shape is a specific type of spatial knowledge (among others), on the other hand shape processing involves the most challenging aspect of spatial knowledge processing since it cannot be dealt with in an abstract manner and it affects all other forms of spatial knowledge.

With the term Cognitive Shape Processing we refer to all forms of knowledge processing involving shape information that are related to, inspired by, or derived from principles found in natural cognitive systems. We thus exclude purely technical approaches to shape processing, however we strongly encourage considering cognitive principles as potential solutions for technical approaches.
Unfortunately, and contrary to many other visuo-spatial aspects of cognition, cognitive shape processing has not yet received the appropriate level of attention in the scientific community.

Considering the potentials of understanding and employing the principles of cognitive shape processing for both basic and applied research, this clearly calls for a joint endeavor in AI and the cognitive sciences to sufficiently address its most fundamental questions.

Goals of the Symposium

The goal of the symposium is to bring together researchers from artificial intelligence and the cognitive sciences to promote the understanding – from a cognitive point of view – of how shape information can be represented, retrieved, (re-)constructed, and integrated with other types of spatial information. We consider this symposium as a kick-off event that is meant to provide the grounds for identifying the most important research questions, for proposing a structuring of the scientific field, and for collecting first perspectives for potential directions of research. The long-term goal is to reach a thorough under standing of how all types of spatial knowledge interact with shape information and of how such interaction actually creates the unique flexibility and integrative processes which we can observe in cognitive shape processing. This understanding is meant to directly inform approaches in cognitive modeling and approaches in AI of processing visuo-spatial information.

Sample questions of interest in cognitive shape processing are:

· How is shape knowledge represented in and retrieved from long-term mental storage, and how can it be represented in and retrieved from technical storage and knowledge bases?

· Is shape knowledge compositional (i.e., constructed from elementary shapes) or are specific shapes uniquely represented?

· Is shape knowledge rather contour-based or area-based? Or neither?

· How do prototypical (categorial) shapes relate to specific shapes?

· How does partial shape matching work, i.e. when only parts of a specific shape are known or visible? What is its representational and procedural basis?

· How can varying levels of granularity be modeled in shape representation and processing?

· Given that both visual and spatial aspects are involved in spatial knowledge processing, how does shape information interact with these modes?

· Is shape information dealt with in 2D, 2½D, 3D, … and how do the dimensions scale up/down?

· What is the role of attentional processes in cognitive shape

processing?

· What is the relation between control processes in visual perception and knowledge about shapes?

· How can brain-imaging studies contribute to the understanding of cognitive shape processing? What stories do eye movements and other behavioral data tell?

The symposium will be scheduled to provide extensive discussion time and group inter actions. There will be a series of presentations with significant question-and-answer time, as well as topic-oriented group breakout discussion sessions.

Organizing Committee

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