

# Cognitive Systems I

Christian Freksa, Thomas Barkowsky, & Holger Schultheis

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## Exercise 6: Mental Images and Spatial Inference.

(to be done in groups of 3-5 students, return per email by 17 July 2006 to [cosy-exercises@informatik.uni-bremen.de](mailto:cosy-exercises@informatik.uni-bremen.de))

Last lecture introduced analogical representations, in general, and mental images, in particular, as special forms of representations employed in human reasoning about space. One distinct characteristic of mental images is that they allow easily accessing knowledge which is only implicitly given. Consider, for example, a person being told “The blue square is left of the yellow triangle” and “The red circle is left of the blue square”. Although that person has never been told explicitly that the red circle is left of the yellow triangle, this relation is easy for the person to determine, because he can form a mental image of the situation from which the relation between the circle and the triangle can be read off virtually without effort.

Your task in this exercise is to computationally model human spatial reasoning with mental images with a particular focus on the characteristic of representing implicitly given knowledge. More precisely, your system should be able to represent given spatial relations between objects like in the above example (left-of (red circle, blue square)). Furthermore, your system should be able to correctly answer questions regarding spatial relations between objects which are not given in the sentences.

Solving this exercise includes (among other things):

- Creating suitable sets of relations and corresponding questions.
- Devising and implementing all the components necessary for the system to do the experiment (where possible you can draw on already existing components from previous exercises).
- Devising and implementing a suitable representation for mental images
- Devising and implementing suitable processes for creating the mental image from given spatial relations (image construction).
- Devising and implementing suitable processes working on the mental image representation which allow reading off implicit knowledge (image inspection).
- Write a clear and comprehensive description of your solution which focuses on the major aspects of your system regarding cognitive plausibility. This written description should include a (commented) trace of your model processing given spatial relations and inferring previously unknown spatial relations
- Prepare an oral presentation which concisely presents the major aspects of your system.

**ATTENTION:** A mental image is an *internal, mental* representation and, thus, sharply and clearly to be distinguished from any representation your system uses to simulate the presentation of *external* visual stimuli.