

# Dagstuhl Seminar 21492: Representing and Solving Spatial Problems

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## Abstract

Everyday life takes place in space and time, and spatial experience lies at the heart of our existence. Understanding how we conceive of spatial relationships, and how we solve spatio-temporal problems, is therefore key to understanding human cognition. Spatial cognition research has advanced considerably over the past decades, with major successes particularly in computational implementations of knowledge representation and reasoning methods. Still, a range of key issues continue to pose major challenges. The goal of this seminar is to discuss the various options for the formalisation, implementation, and automated solution of spatial problems including the following issues: the identification and specification of relevant concepts as expressed in human language; the development of a module for automated understanding of domain descriptions; the use of spatial structures and affordances for direct spatial problem solving; and, the development of an efficient planning system capable of providing feasible solutions to spatial problems.

## 1 Detailed schedule

### Monday, December 6th

- 9:00–10:30: Plenary session: presentation of the seminar topics  
Introduction (15min each):
  1. Conceptualisation: Paulo Santos
  2. Formalisation: Pedro Cabalar
  3. Description: Thora Tenbrink

#### 4. Problem Solving: Zoe Falomir

Participants should position themselves with respect to these topics and, in particular, answer the following questions:

- Which topics would you like to contribute to?
- What are your visions for future research and developments?
- What are the main challenges involved?

#### 10:30–10:45: Coffee break

- 10:45–12:15: Preparation of break-out groups, and research questions, including (but not limited to):
  1. How do humans conceptualise and mentally represent spatial problems?
  2. What is the role of high-level spatio-temporal structures for perceiving spatial problems, for manipulating spatial configurations, and for commonsense spatial problem solving?
  3. What would be a suitable formalism for commonsense problem solving that allows an accurate, flexible and readable knowledge representation for spatio-temporal effects of actions performed by an intelligent agent?
  4. How to develop human readable descriptions of the inputs, reasoning steps and solutions of spatial problems?
  5. Whether (and to what extent) is it possible to develop high-level representations or interfaces for dealing with natural language and/or diagrammatic structures that allow specifying both the input knowledge and the output conclusions in terms of textual descriptions of spatial problems?
  6. Would it be possible (and desirable) to develop interfaces for dealing with spatial configurations including diagrammatic depictions and natural language descriptions to solve spatial puzzles in similar ways as humans do?
  7. What are the commonsense problem solving capabilities involving spatio-temporal features including temporal explanation and planning under physical/geometric qualitative or semi-quantitative constraints?

#### 12:15–14:00 Lunch Break

- 14:00–15:30: Break-out group discussions


#### 15:30–15:45: Coffee break

- 15:45–17:15: Online session
  - 15:45–16:15 Summary of Monday discussions
  - 16:15–17:15 Debate with online participants


## Tuesday, December 7th

9:00–10:30: Online session


- 9:00-9:30 Summary of Monday discussions
- 9:30-10:30 Debate with online participants

 10:30–10:45: Coffee break

10:45–12:15: Break-out group discussions


 **12:15–14:00 Lunch Break**


14:00–15:30: Plenary session - summary of the morning breakout groups

 15:30–15:45: Coffee break

15:45–17:15 - Break out groups


## Wednesday, December 8th

 9:00–14:00: Social event:  
walk and visit to Wadern

 **12:15–14:00 Lunch**

14:00–15:00: plenary session: result of Tuesday break out groups

15:00–16:00: Panel on Christian Freksa's visions  
Participants: Everyone is welcome

 16:00–16:15: Coffee break


16:15–17:15: plenary session

1. discussion of the current status of concepts and approaches within and across the four main topics of the seminar
2. future papers titles and abstracts


## Thursday, December 9th

9:00-9:30 Summary of Tuesday and Wednesday discussions

9:30-10:30 Last break-out group discussions

 10:30–10:45: Coffee break

10:45–12:15: Debate  
the results of the first three days should be arranged and integrated in such a way that we have an outcome of the seminar that is of use.

 **12:15–14:00 Lunch Break**

14:00–15:30: Plenary session - plan for further collaborations

1. Follow-up meeting (IJCAI workshop? AAAI Spring Symposium? Another Dagstuhl seminar?)
2. Journal special issue – possible target: Spatial Reasoning and Computation Journal
3. Handbook
4. Joint publications

☕ 15:30–15:45: Coffee break

15:45-16:30 - Invited talk: Stefania Costantini - AI and Digital Forensics

☑ 16:30 –17:30: Wrap-up session

**📅 THERE IS NO SESSION ON FRIDAY, December 10th**