# Thinking with Representations

Johan Blomkvist

# Today's agenda

- Course information


- Distributed/situated cognition
- External representations and design


- Group project reveal and startup

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# Course content

- Focus on learning
- This requires effort from the student

# Course content

- The students of this course develop their and knowledge about what the roles of representations are in design, including the ability and knowledge to use different tools to plan and use representations, by conducting a series of assignments and using literature from design and cognitive science to reflect on their process.

- Emphasis is put on reflecting in- and on action to further the understanding of mechanisms for learning with the help of representations and the connection between the built representation and the knowledge it makes available. The more general implications for design of placing representation at the center of the design process is also considered in the course.

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# Course info

After the course, the student shall be able to:

- Understand, describe and apply foundational concepts from distributed cognition

- Apply knowledge about how to represent alternatives in a design space and reflect on the value of those representations

- Use and develop tools and methods for representations, and reflect on what the tools enable and confine

- Systematically reflect on and show knowledge about how to represent complex situations on a detailed as well as holistic level

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# Course info

- 6 credits
- Quarter speed
- Teaching tutoring each Monday morning
- Scheduled work
  - 30 hours teaching/tutoring (excl. individual proj.)
  - 36 hours individual project work
  - 50 hours group work
- 30 hours estimated for reading

Tot 146/160hrs

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# Course content

- Teacher, examiner, tutor
  - Johan Blomkvist
- Learning opportunities
  - Lectures
  - Tutoring
  - Seminars
  - Group work

# Lectures

- Mostly theoretical

- Not always directly applicable to your projects

- Broadening the discussion

- 3 scheduled occasions (subject to change based on your expressed needs)

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# Tutoring

- Teaching sessions in the schedule

- 6 occasions (also subject to change and not including individual tutoring)

- We do work related to your projects together

- The tutor is present to bounce ideas and discuss your work

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# Seminars

- Based on research articles
- Three themes (and three seminars):
  - Representations and thinking
  - Representations and learning
  - Representations and transformation

# Group work

- Three stages:
  1. Prototype an artefact
  2. Prototype a context with artefact(s)
  3. Prototype a service

Context

Artefact
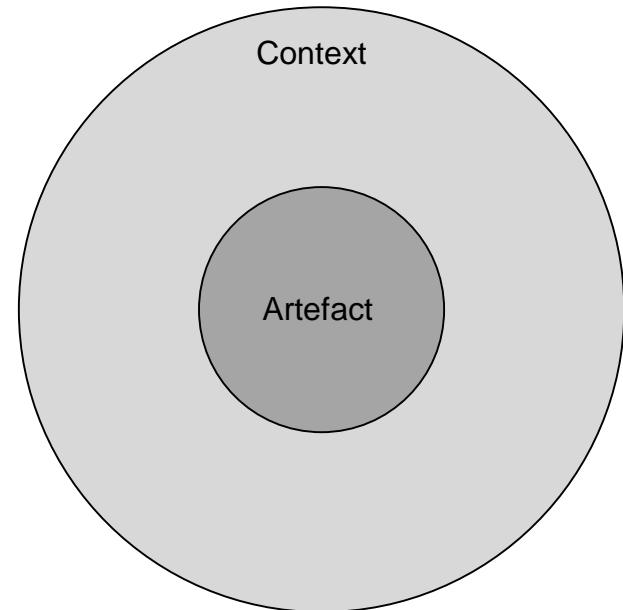
# Gruops

# Individual assignment

- Write a research proposal

- The proposal is a 10 page document outlining a potential project around some aspect related to the course topic

  - Proposals can include 2 or more, but not less, of the following areas:

    - Design

    - Representation

    - Distributed cognition

    - Prototoyping

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After the course, the student shall be able to:

- Understand, describe and apply foundational concepts from distributed cognition <- lectures + seminars + individual assignment

- Apply knowledge about how to represent alternatives in a design space and reflect on the value of those representations <- group work + teaching sessions

- Use and develop tools and methods for representations, and reflect on what the tools enable and confine <- group work + lectures

- Systematically reflect on and show knowledge about how to represent complex situations on a detailed as well as holistic level <- individual assignment

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# Course info

| UPG1 | Individual assignment | U,3,4,5 | 3 credits |
|------|----------------------|---------|-----------|
| UPG2 | Group assignment | U,G | 3 credits |

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- First tutoring session on Monday
- Bring pen and paper

# Thinking with Representations

# What's in a name?

- Thinking with Representations

- Thinking with EXTERNAL Representations

- Representationer som tänkande (Representations as Thinking)

# What's in a name?

- Billman (1999), five realms of representation:
  - External, representations in the world such as maps, models, writing

  - Mental, internal representations of knowledge used in cognitive processes such as reasoning, perception, language, problem solving and so on.

  - Computational, representations used by a computer to perform similar tasks as mental representations

  - Theoretical, abstract models representing a theory of something

  - Physiological, areas of the brain where things are materially represented

# Cognitive science

- 19th- and early 20th century research about "cognition"

  – Psychology and philosophy

  – Introspection


  – As a reaction, behaviourism ignored (potential) internal processes and observed, and measured, only behaviours

# Cognitive science

- In North America, Cognitive science was a counterreaction in the early 1950s

- Artificial intelligence tried to model human cognition (not behaviour)

- Problem solving

- Chess


- Computers beat humans in closed-world problems

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# Cognitive science and distributed cognition

- Humans beat computers at real-world (unconstrained) problem-solving tasks

- Humans offload memory onto the physical world

- Quick visual overview of e.g. chess

- Scholars started looking at "distributed cognitive tasks" (Zhang & Norman, 1994; Scaife & Rogers, 1996)
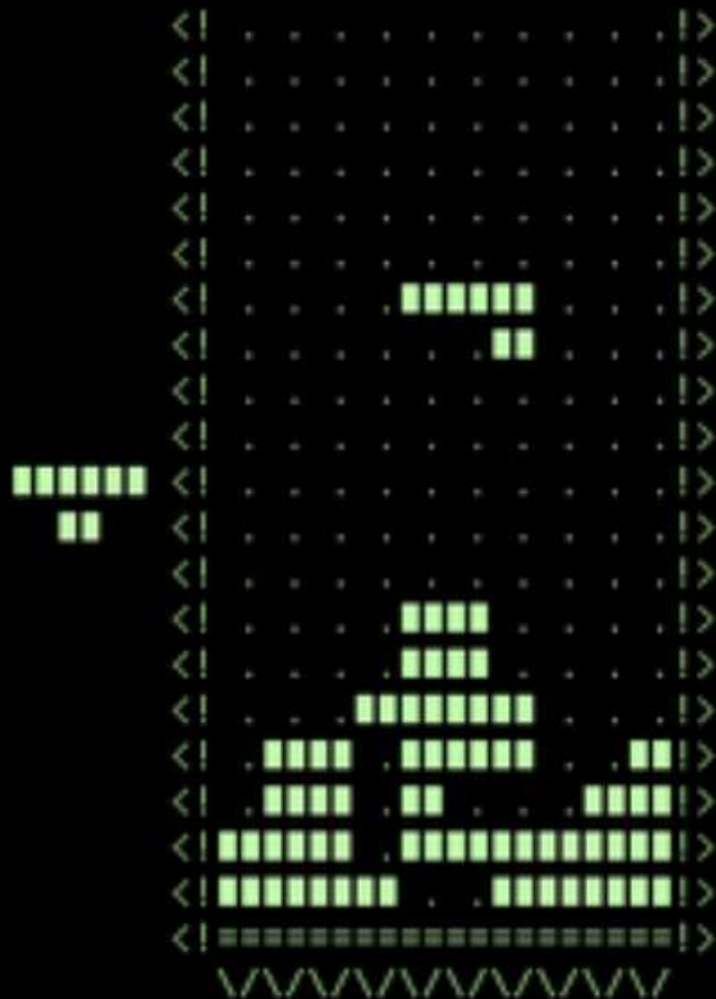
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# Distributed and situated perspectives

- In 1988, Jean Lave wrote that cognition:

"in everyday practice is distributed – stretched over, not divided among – mind, body, activity and culturally organized settings (which include other actors)" (p. I)

- Many different names with slightly different meanings:
    - Situated action (Suchman, 1987)
    - External cognition (Scaife & Rogers, 1996)
    - Situativity theory (Greeno & Moore, 1993)
    - Distributed cognition (Rogers & Ellis, 1994; Holland, Hutchins, & Kirsch, 2000)
    - Extended mind (Clark & Chalmers, 1998)

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# Distributed and situated perspectives

- A situated perspective:
  - Cognition is
    - Embodied – we think not only with our mind but also with our body.
    - Embedded – we think in a context. The situation influences what and how we think, not only the environment but also the social and cultural context.
    - Extended – perhaps most controversial. We think also <u>with</u> the environment. More or less literal interpretations exist, one common view is to think of people and environments as cognitive systems or dynamic systems.

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https://en.wikipedia.org/wiki/Tetris#/media/File:Tetris-VeryFirstVersion.png

# Distributed and situated perspectives

- Pragmatic and epistemic actions
  - Expert tetris players "fiddle" more than novice players
  - Why?
  - Manual rotations quicker than mental
  - Manual rotations allow players to "see" the best orientation and placement
  - Similar pattern for Scrabble when allowed vs. not allowed to manipulate the words (produce more words)

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To conclude:

- people can perform processes faster,
- with more precision, and
- for a longer time-period

when using external rather than internal representations (Kirsh, 2010).

# Distributed and situated perspectives

- Is leaving a note by the door the same as "storing" a memory in the brain?

- Is using a calculator or a pen and paper to solve a math problem the same as doing it in the head?

- What on earth does this have to do with design?

- From a distributed cognition perspective – the design output is necessarily tied to the external representations used since:

  – They are part of the cognitive processes that lead to them!

# Distributed cognition and design

- What is an external representation in design?
- Designers work with many external representations (externalisations)
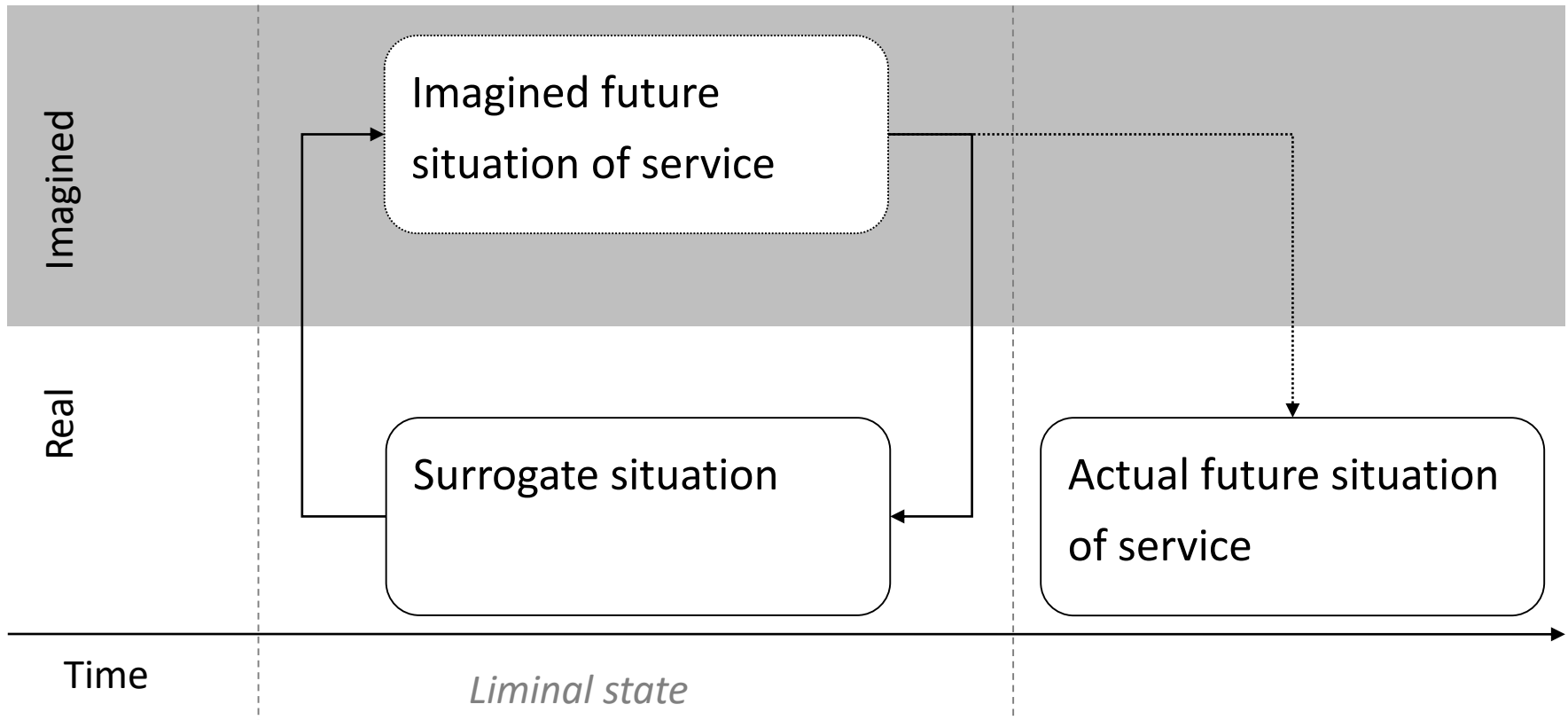
# Distributed cognition and design

- Service designers do not have a "material"

- They traverse between the actual physical world and ~ (visual) descriptions of service

- Visualisations

- Prototypes

FIGURE 5: THE CUSTOMER JOURNEY FOR A PASSENGER BEFORE A FLIGHT: BOOKING A FLIGHT – CHECK-IN – SECURITY CHECK – BOARDING – ON BOARD ETC.

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Figure 3: Illustration of the interplay between the surrogate situation and the future situation in prototyping. P. 65

Action context & Target context, Artman, Ramberg, Sundholm & Cerratto-Pargman (2005)

# Distributed cognition and design

- Marking (Kirsch, 2010), embodied cognitive practice

**Small vs. Large Marking**

**Hand Marking**

Fig 1a

Fig 1b

Fig 2a

Fig 2b

Fig 2c.

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# Distributed cognition and design

- Gestures (Arvola & Artman, 2006), embodied cognitive design practice

# Distributed cognition and design

- A surrogate is both the built representation and the people who use it

- A central idea of the course is to explore and learn about the relation between surrogate situations and future situations of service, including what different material manifestations of ideas mean for the creation of knowledge in design

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Artman, H., Ramberg, R., Sundholm, H., & Cerratto-Pargman, T. (2005). Action context and target context representations: A case study on collaborative design learning. In T. Koschman, D. Suthers, & T. W. Chan (Eds.), Computer supported collaborative learning 2005: The next 10 years! Mahwah, NJ: Lawrence Erlbaum.

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# Group assignment 1

Artefact representation

# Group work

- Assignment
    - One way to decrease environmental pressure from food consumption is to decrease travel
    - A current trend is to allow customers to order groceries and have them delivered to their homes
    - This leads to many changes in the way grocery stores work
    - The first assignment is to design an artefact that helps the staff to pack groceries in the store

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- Something that helps with Picking and packing food

- Requirements:
  - An "artefact"
  - Not a screen, not a trolley
  - To be used by unskilled workers (without specific training)
  - Must be possible to implement and use today
  - Must save time for the store