

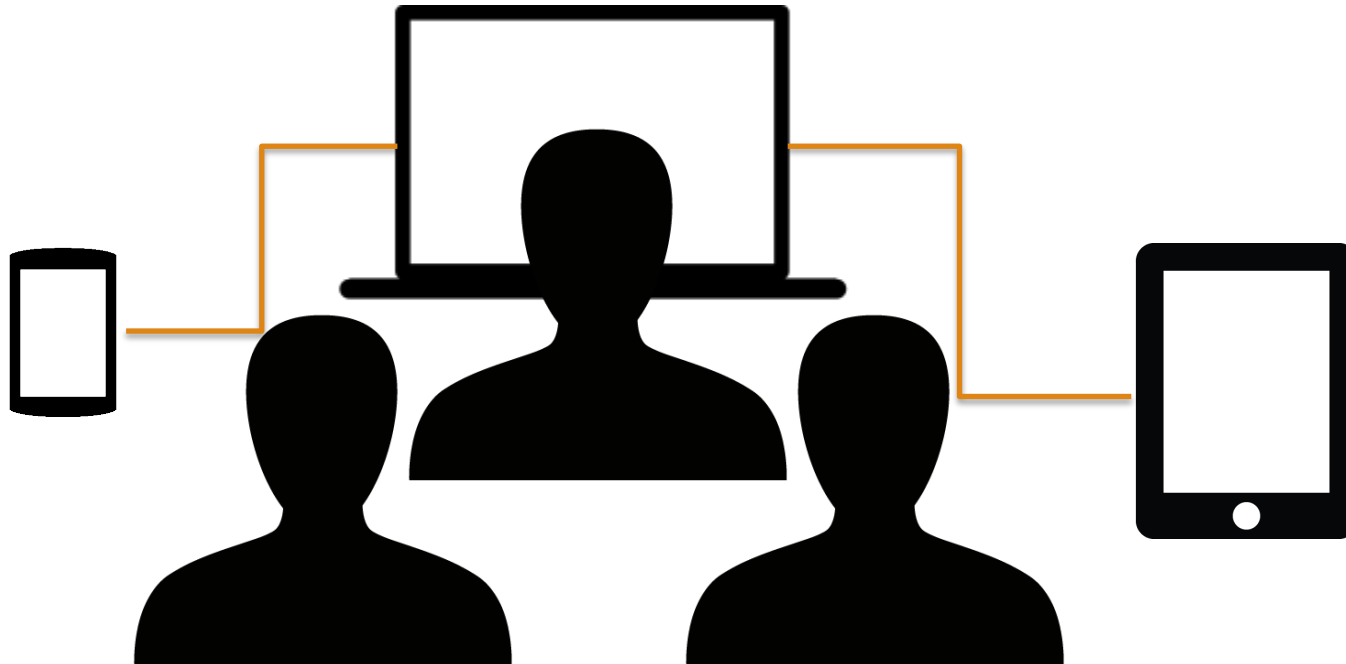


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An Artifact Ecology in a Nutshell: A Distributed Cognition Perspective for Collaboration and Coordination

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INTRODUCTION



- Physical and digital worlds are tightly interwoven and people experience a blended space as a whole.
- The experience of user is spread across devices, across physical or digital spaces and over time, therefore we need to consider that as a whole.
- The design of “micro-interactions” remains important, but there is a bigger picture to consider in terms of collaboration and coordination.

BACKGROUND

- [Artifact Ecology]

Artifact Ecology:

- Space rich in technological tools with which individuals interact. These technologies communicate and share information with each other creating their own network.

Artifact Ecology for Collaborative Activities

- Digital and physical artifacts within the artifact ecology may be used for a variety of tasks while each individual may perform a task differently.
- Importance of what affordances or constraints different technologies such as mobile devices can bring to an artifact ecology.
- Need to understand what each one of these technologies brings to the collaboration and coordination of group-work.

BACKGROUND

- [Distributed Cognition]

Traditional Evaluation Methodologies:

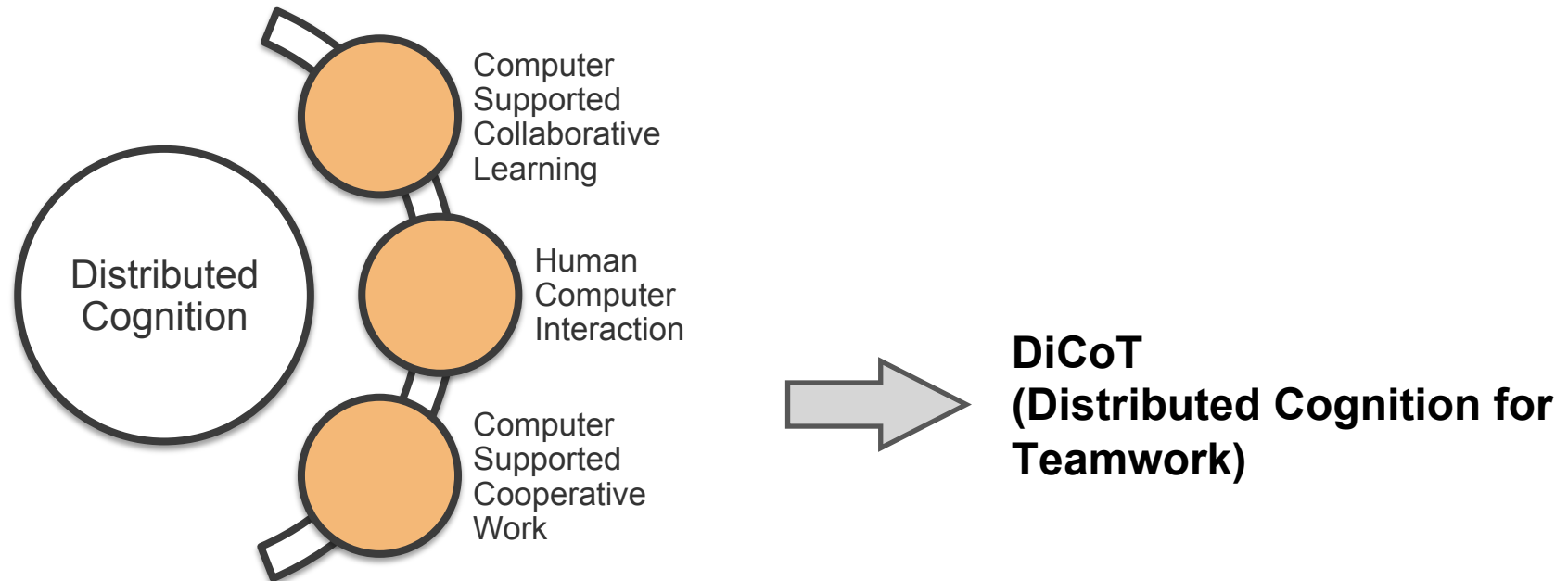
- Unable to reflect the unpredictability of a real-world context
- Fail to capture the complex interactions enclosed in a multi-tool and multi-participant environment.

Distributed Cognition (DC)

- Analyses cognition in a distributed manner, while it considers an activity taking place across individuals, tools and representations as one cognitive system, instead within an individual's mind.
- Was considered an ideal framework to disclose the fundamental processes for collaborative activities in a multi-participant, multi-tool environment.

BACKGROUND

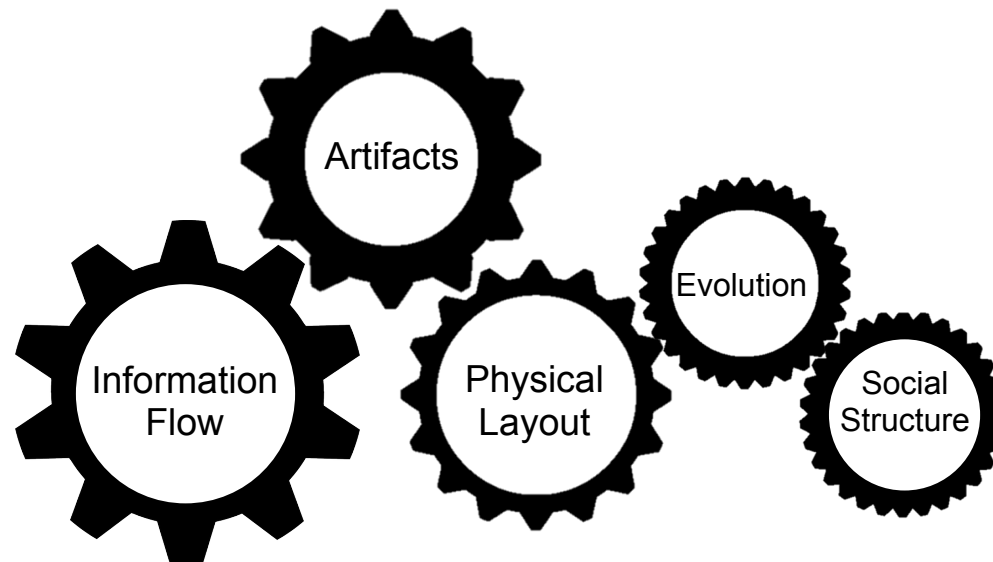
- [Distributed Cognition]



BACKGROUND

- [DC for Teamwork]

- DiCoT: Combines the DC framework and the methodological structure of Contextual Design
- Provides a structure for applying Distributed Cognition and a methodological framework to investigate and understand humans in a socio-technical environment
- Encloses 22 principles, classified in five models



RESEARCH OBJECTIVE

The overarching aim of the study is to expand our understanding over the learner-learner and learner-artifact interactions evident in an artifact ecology around a design problem.

- Illustrate the transferability and utility of distributed cognition (DC) and DiCoT as tools for modelling interactions and interdependencies during collaborative learning activities in an artifact ecology.
- Highlight the affordances of the ecology of artifacts that support collaboration and coordination.



METHODS

- [Participants] [Context] [Task]

Participants

- 21 postgraduate students (13 female) in a HCI course
- Working in multidisciplinary groups of four to five students

Context

- The course was organized in three-hour weekly face-to-face sessions and followed a problem based learning (PBL) approach, including phases of analysis, research, reporting and reflection
- The tutor provided a short lecture at the beginning of each session in order to provide a triggering point for students' self-directed learning
- Students work in groups for the collaborative activities, which focused on providing hands-on experience

Design Task

- “Changing the Perspectives of Public Transport”

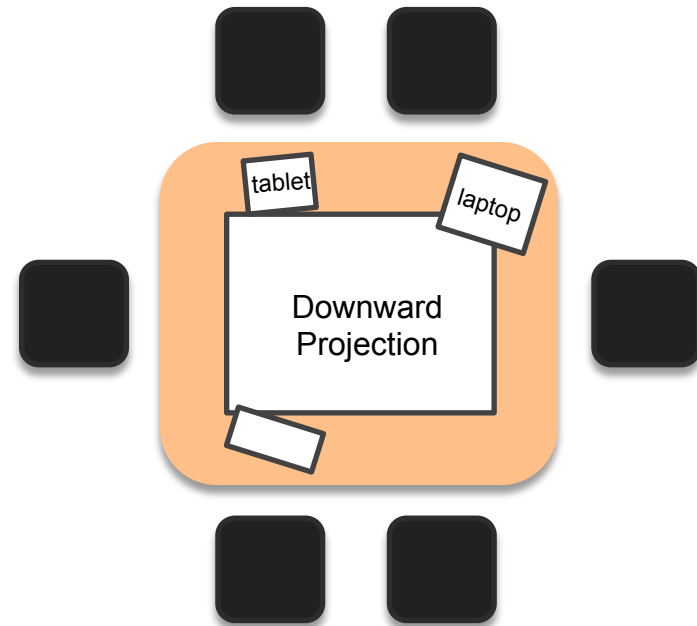
METHODS

- [Artifact Ecology]

We enriched the course with four identical technology rich settings that aimed to support student collaborative activities around a design problem.

We provided:

- A downward pointing projection for central focus
- Mobile devices for multitasking
- Facebook Group for information sharing and coordination



METHODS

- [Data Collection and Analysis]

1

Field Notes

Indicate a preliminary system description

- Properties and sketches of the physical layout
- Communication between participants
- Emerging artifacts

2

Focus Groups

Thematic analysis based on DiCoT models

- Aspects of the physical layout of each group
- Communication channel protocols of each group
- Uses and purposes of artifacts

3

Video Data

Triangulation of findings and extending descriptions

- Snapshots of the physical layout in use
- Communication examples based on the transcription of selected episodes
- Artifacts physical movement and information flow

FINDINGS

- [Physical Layout]

The physical layout model covers aspects of collaborative learning activities that have a physical layout component.

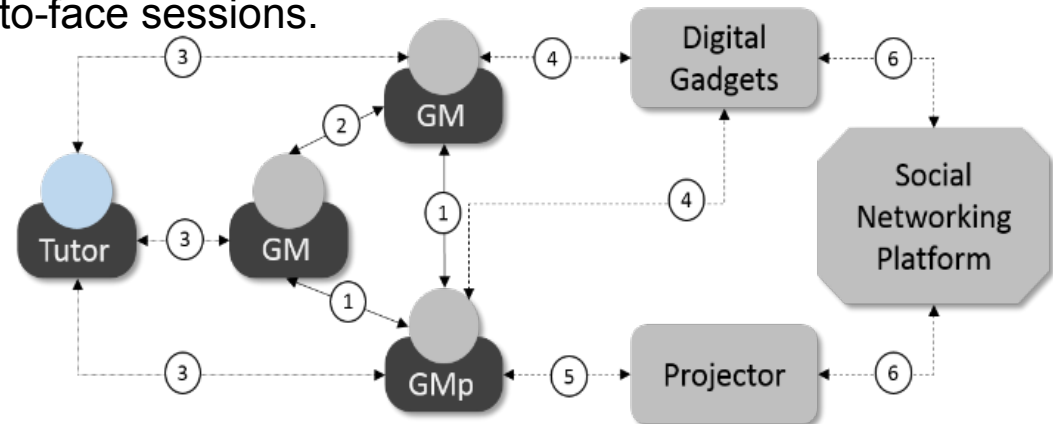
- **Arrangement of equipment:** Downward projection was used for research purposes and projecting group artifacts, e.g. working documents or groups' Facebook.
- **Horizon of observation:** Group members were within each other's zone of normal hearing which resulted in listening to the conversations and issues raised by their group-mates.
- **Subtle Bodily Supports:** Learners used bodily movements to support their discussion of artifacts projected on the shared workspace, e.g. pointing to screen area.

FINDINGS

- [Information Flow]

The information flow model pays attention to the way information propagates around the cognitive system.

- **Communication Bandwidth:** The communication between the learners happened informally and face to face.
- **Decision Hub:** Learners gathered around the downward pointing projection, brainstormed, identified learning issues, researched and acted as a united information decision hub.
- **Information Buffer:** The social networking platform was used particularly to support communication between face-to-face sessions.



FINDINGS

- [Artifacts]

The artifact model focuses on the analysis of individual artifacts that are deemed important within the cognitive system.

- **Mediating Artifacts:** In this case, the downward projection, mobile devices and Facebook emerged as key mediating artifacts during the collaborative activities.
- **Coordination of Resources:** As a coordination tool, Facebook captured the storyline of the group work, keeping a record of shared resources and issues discussed.
- **Creating Scaffolding:** Facebook group offered the ability to categorize posts in themes or associate a post to an individual.

IMPLICATIONS

- [DiCoT for Collaborative Learning]

DiCoT as a Modelling Tool for Collaborative Learning Activities

- The analysis demonstrated how the technological set-up (i.e., the artifact ecology) impacts the access to artifacts and the propagation of information through the cognitive system.
- The artifact and information flow models highlighted the distinguished roles that technological artifacts such as the downward projection, mobile devices and social networking platform have in the artifact ecology.

IMPLICATIONS

- [Affordances of Artifact Ecology]

Affordances of Artifact Ecology & Design Implications

- Close proximity increases awareness and supports distributed cognition by observing and listening to the issues raised by other group members.
- Lengthy procedure for a group member to express an idea to be recorded or explored through the projection, resulting in delays in the collaborative activities.
- Overcome lengthy procedures by
 - (i) enabling collaboration on shared artifacts,
 - (ii) supporting pooling of information from previous sessions,
 - (iii) allowing tracking of decisions and (iv) enables continuity in learners interactions across time and space.
- Use secondary displays and interactive screens for sharing awareness and providing behavioural trigger points to:
 - (i) support note taking and creating checklists,
 - (ii) allow tagging for organization purposes and
 - (iii) support notifications on group progress, can improve the collaboration and coordination of the group.

CONCLUDING REMARKS

- [Limitations and Future Directions]

- Lack of a detailed analysis of the dynamic and constantly changing artifacts
- Extending our analysis to include a temporal dimension, taking into account how users, tasks and tools change over time

Thank you!

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