COLLABORATIVE ACTIVITY IN AUGMENTED SPACES

Keynote proposed by Prof. Dr Ir Arch. Pierre Leclercq
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University of Liège • Belgium

AGENDA

LUCID • Lab for User Cognition & Innovative Design
presentation - paradigm
Collaborative scenario
work case - LUCID spatial augmented spaces
Research question
"how do digital media affect synchronous collaborative activities"?
Collaborative situations
tasks x SAR x application fields
Discussion
new status: documents, co-actors, work spaces, ...
Conclusion

LUCID Presentation

Research unit @ University of Liège, Belgium

University of Liège
Faculty of Applied Sciences
Architecture Geology Building eng.
Design engineering & CHI

11 Faculties
3 departments
18 research units
LUCID
**LUCID Presentation**

**Lab for User Cognition & Innovative Design**

- Multidisciplinary research team in design engineering (since 2001)
  - Design Engineering / Computer sciences / Cognitive ergonomics
  - 15 researchers + 10 master and PhD students / 10 on going research projects
- R&D aims
  - Design Computing & Cognition + Human Machine Interactions in design

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**LUCID R&D aims**

**Design support and decision making**

- Cognitive analysis of design tasks
- Multimodal interactions in design
- Collaborative processes in design

**Design computing**

- Product modeling : 3D mockups, technological models
- Product performances evaluation

**Advanced technologies**

- Multimodal interfaces : sketch, annotation, gesture, vocal
- Digital tables and electronic pen interfaces

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**LUCID Education**

**Faculty of Applied Sciences (Bac) : Architecture & Building engineering**

- Project Methodology [180h]
- Computer Aided Architectural Design [90h]

**Faculty of Applied Sciences (Mas) : Architecture & Building engineering**

- Architecture Studio [150h]
- Collaborative Digital Studio [60h]
- Design Process Analysis [60h]

**Faculty of Psychology (Ct Mas)**

- Design and Assessment in Ergonomics [24h]

**Faculty of Applied Sciences (PhD)**

- Doctoral seminars : digital architecture

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**LUCID Paradigm**

**User centered approach > Human Machine Interaction**

**Going over the WIMP interface**

- Window Icon Menu Pointer
- Explicit and not compatibles with design tasks : can’t follow the human thinking flow
LUCID Paradigm

User centered approach > Human Machine Interaction

‣ Invisible tool > the ubiquitous computer paradigm

COLLABORATIVE SCENARIO - WORK CASE

Persistent problem for companies in many (design) fields

Collaborative contexts | Same time | Different time
--- | --- | ---
Same place | co-attendance meeting | post-it, mail box, file server, BIM, PLM
Different places | Collaborative Studio based on AR | mail box, file server, BIM, PLM

CSCW Matrix - Computer Support for Collaborative Working [Johansen, 88]
**USE OF AR - AUGMENTED REALITY**

**Definition**
- Real-time overlay of virtual information on the visual perception of reality (Furth, 2011)
- 3 kinds of AR

**Diff**erent kinds of AR: in our case, AR is implemented in specific spatial configurations

- **SAR = Spatial Augmented Reality**
  - documents are projected on real surfaces (table, board, wall, desk, tablet ...)
  - manipulated and annotated with a pen

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**SketSha and the Collaborative studio**

Support for remote graphical and synchronous collaboration (2007)

**SketSha - Sketch Sharing software**

Graphic User Interface

- Digital penbox
- Annotations
- Imported plans
- Distant pencil mark
- Layout handling
- Layout Manager
- Imported plans
**RESEARCH QUESTION**

How do these new SAR configurations affect collaborative activities?

- 4 tasks x 4 SAR

<table>
<thead>
<tr>
<th>Authoring</th>
<th>Expertise</th>
<th>Project review</th>
<th>Teaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tablet</td>
<td>Desk</td>
<td>Meeting</td>
<td>Wall</td>
</tr>
</tbody>
</table>

**RESEARCH QUESTION**

How do these new SAR configurations affect collaborative activities?

- 3 application fields

- LAB: Scientific research
- Spatial Augmented Reality
- OFFICES: Professional practice
- CLASSROOM: Advanced learning
COLLABORATIVE SITUATIONS
SAR configurations implemented to support collaborative activities

Digital studios @ LUCID-ULg: 120 m² of experimentation / teaching platform

- Studio 1 - 40 m²
  - meeting room - 10 p.

- Studio 2 - 60 m²
  - classroom - 15 p.

- Interactive wall

Audio-video observation

processing and analysing of hundreds of hours of video tapes / coding grids

(cfr S. Ben Rajeb: collaboration analysis method and the “COMMON Tools”)
**LAB**

Fundamental research: ARC COMMON 2011-2015

![Diagram illustrating new construction of meaning, new technology, and new organizational context]
#4 ADVANCED LEARNING

Public jury session

‣ with evaluators at ULg and distant evaluators at EM Alès

#5 PROFESSIONAL PRACTICE

Collective design

‣ Architecture and design: Art & Build [Brussels - Toulouse], Lallemand & Associates [Brussels]
‣ Engineering: GSK - Jacobs [Brussels - Paris], BEG Greisch [Liège-Brussels]

#6 PROFESSIONAL PRACTICE

Consultancy between neuro-surgeons

‣ CHU Liège (Belgium) - CHU Montréal (Canada)

DISCUSSION

How do these new SAR configurations affect collaborative activities?
DISCUSSION
How do these new SAR configurations affect collaborative activities?

‣ emergence of new status
  - status of the document
  - status of relationship between actors
  - status of the collective workspaces
  - status of meetings

STATUS OF THE DOCUMENT
Interactive shared artifact

‣ with immediate "action/perception" negotiating and building consensus between actors

STATUS OF THE DOCUMENT
Interactive shared artifact, drawn with "both hands"

‣ new ways to build juxtaposition of representations through a cross-interpretation

STATUS OF THE DOCUMENT
Interactive shared artifact, drawn with "both hands"

‣ new ways to draw one common sketch created by two hands
STATUS OF RELATIONSHIP BETWEEN ACTORS

Interactive shared artifact

- re-balancing between actors (who can act each)

STATUS OF THE COLLECTIVE WORKSPACES

The "co-presence/remote" dichotomy in SAR has to be reviewed

- example of augmented co-presence in a meeting @ ULg

<table>
<thead>
<tr>
<th>Collaborative contexts</th>
<th>Same time</th>
<th>Different time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same place</td>
<td>Real presence</td>
<td>Asynchronous exchange</td>
</tr>
<tr>
<td></td>
<td>Augmented</td>
<td></td>
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<tr>
<td></td>
<td>presence</td>
<td></td>
</tr>
<tr>
<td>Different places</td>
<td>Virtual</td>
<td>Remote asynchronous exchange</td>
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<tr>
<td></td>
<td>co-presence</td>
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</table>

[Ben Rajeb & Leclercq 2014]
STATUS OF MEETINGS

Professional practice: new types of collaborative work meetings

- Example:

GSK [Brussels] - Jacobs [Paris]: 3 months of meetings observation

<table>
<thead>
<tr>
<th>Duration</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short appointments (&lt; 15’)</td>
<td>13</td>
</tr>
<tr>
<td>Appointments (&lt; 30’)</td>
<td>19</td>
</tr>
<tr>
<td>Short meetings (&lt; 45’)</td>
<td>15</td>
</tr>
<tr>
<td>Meetings (&lt; 1h)</td>
<td>7</td>
</tr>
<tr>
<td>Long meeting (&lt; 2h)</td>
<td>12</td>
</tr>
<tr>
<td>Very long work meeting (&gt; 2h)</td>
<td>5</td>
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Duration of longest observed meeting: 3h19’
Mean duration of observed meetings: 39’
Mean number of weekly meeting: 6

CONCLUSION

Contributions of SAR configurations to collaborative activities

- From a large experimental panel:
  4 collaborative tasks × 4 spatial augmented realities × 3 application fields

Limitation

- Flexibility between co-workspaces [I-space, Space-between, We-space] still have to be managed
- Challenge: creating a “graphical aparté” between actors, in distant situations as well as in co-presence collaboration
CONCLUSION

Prospects: flexibility of access

- the next SAR generation will have to enable users to easily move between the shared work spaces with other intermediary augmented spaces
- use of a personal work space, (un)shared with others: Cintiq Companion, iPad Pro?

References


THANK YOU

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LUCID

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