



COLLABORATIVE ACTIVITY IN AUGMENTED SPACES

Keynote proposed by Prof. Dr Ir Arch. Pierre Leclercq
LUCID - Lab for User Cognition & Innovative Design
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

Intro | Scenario | Research question | Collaborative situations | Discussion | Conclusion

LUCID Presentation



Intro | Scenario | Research question | Collaborative situations | Discussion | Conclusion

LUCID Presentation

Research unit @ University of Liège, Belgium

University
of Liège

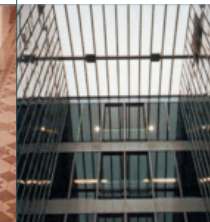
Faculty
of
Applied Sciences

Architecture
Geology
Building eng.

Design
engineering
& CHI



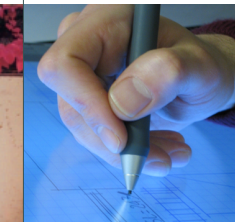
11 Faculties



3 departments



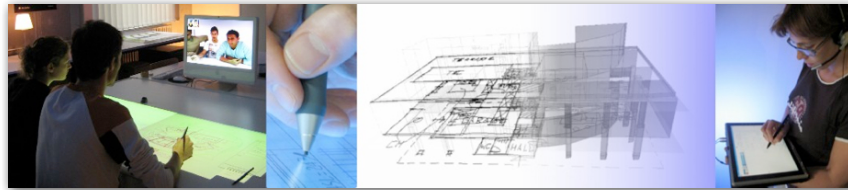
18 research units



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

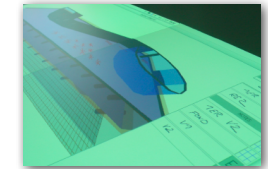
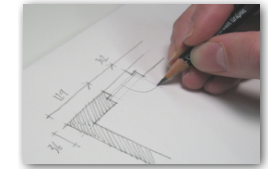
- ▶ Cognitive analysis of design tasks
- ▶ Multimodal interactions in design
- ▶ Collaborative processes in design

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

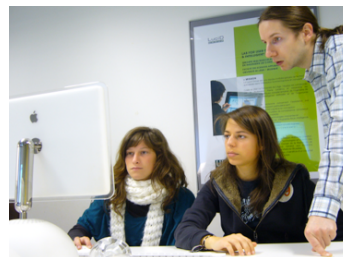
- ▶ Architecture Studio [150h]
- ▶ Collaborative Digital Studio [60h]
- ▶ Design Process Analysis [60h]

Faculty of Psychology (Ct Mas)

- ▶ Design and Assessment in Ergonomics [24h]

Faculty of Applied Sciences (PhD)

- ▶ Doctoral seminars : digital architecture



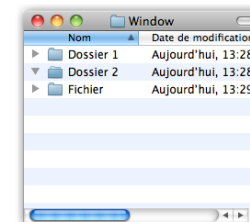
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LUCID Paradigm

User centered approach > Human Machine Interaction

Going over the WIMP interface

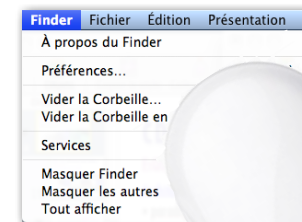
- ▶ Window Icon Menu Pointer
- ▶ Explicit and not compatibles with design tasks : can't follow the human thinking flow



Icon



Another icon

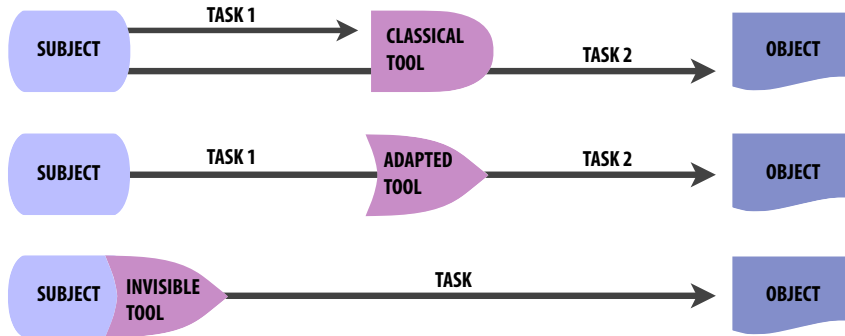


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LUCID Paradigm

User centered approach > Human Machine Interaction

> Invisible tool > the ubiquitous computer paradigm



COLLABORATIVE SCENARIO - WORK CASE



COLLABORATIVE SCENARIO - WORK CASE

Persistent problem for companies in many (design) fields



Investor
Paris

Building site
Monaco

Architecture firm
Brussels

Engineers office
London

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



USE OF AR - AUGMENTED REALITY

Definition

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



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USE OF AR - AUGMENTED REALITY

Definition

- ▶ Real-time overlay of virtual information on the visual perception of reality (Furth, 2011)
- ▶ Different 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]



Documents

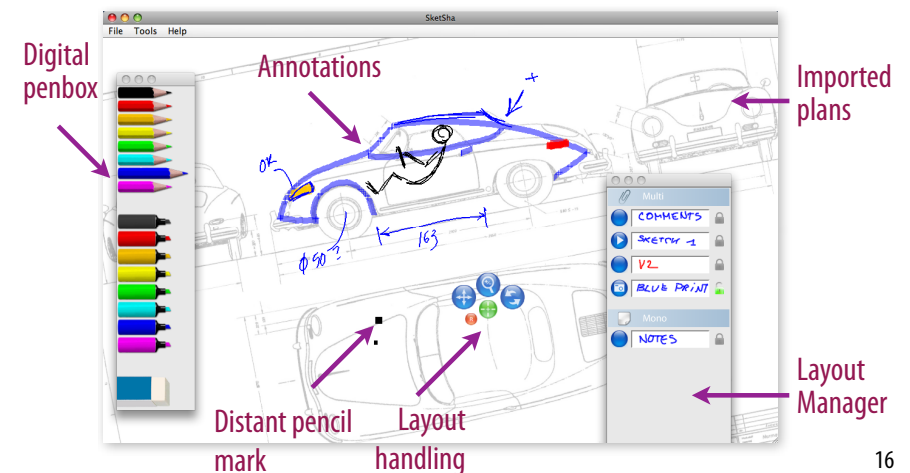
SketSha : sharing documents and annotations in real time

Documents

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SketSha - Sketch Sharing software

Graphic User Interface



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SketSha - Sketch Sharing software

Full pen interface



RESEARCH QUESTION

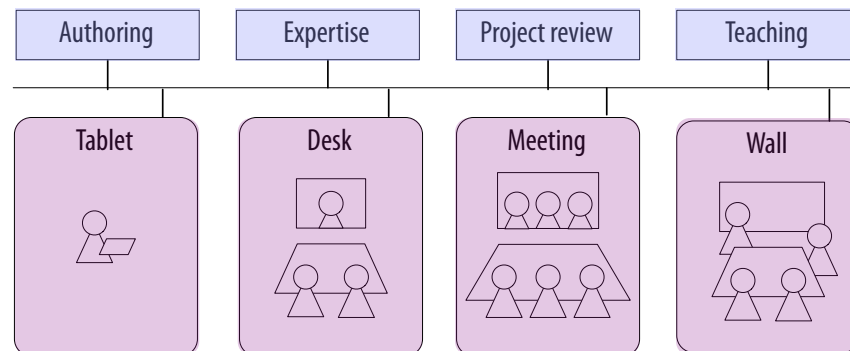
How do these new SAR configurations affect collaborative activities ?



RESEARCH QUESTION

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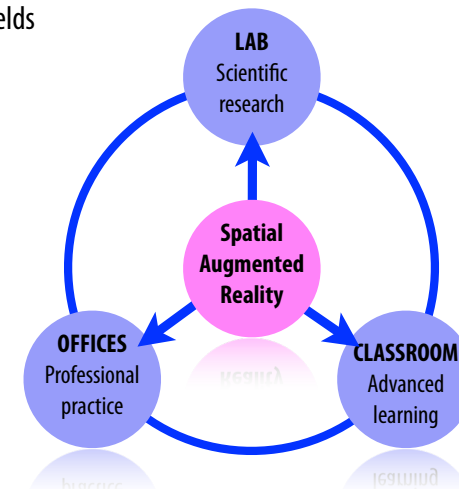
► 4 tasks x 4 SAR



RESEARCH QUESTION

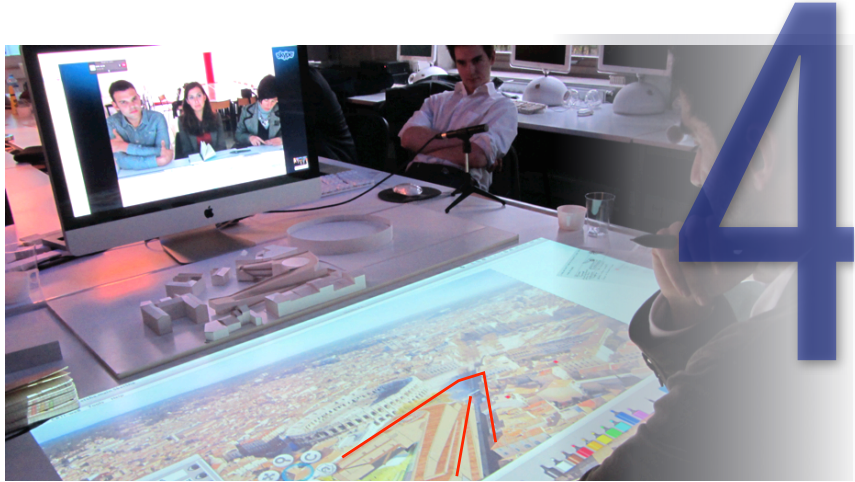
How do these new SAR configurations affect collaborative activities ?

► 3 application fields



COLLABORATIVE SITUATIONS

SAR configurations implemented to support collaborative activities



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.

Control room
20 m2

Studio 2 - 60 m2
classroom - 15 p.

Interactive
wall

LAB

Digital studios @ LUCID-ULg : network



Université
de Liège



Lund
University



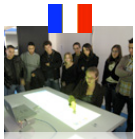
ETS
Montréal



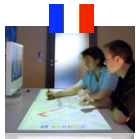
Université
de Montréal



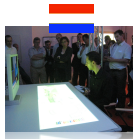
Université
Paris 8



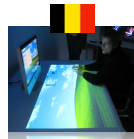
ENSA
Nancy



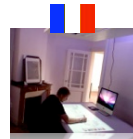
Ecole des Mines
d'Alès



LIST
Luxembourg



Université Cath.
de Louvain

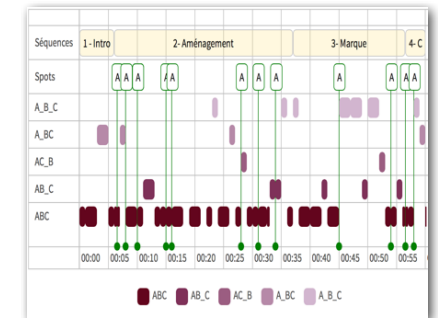
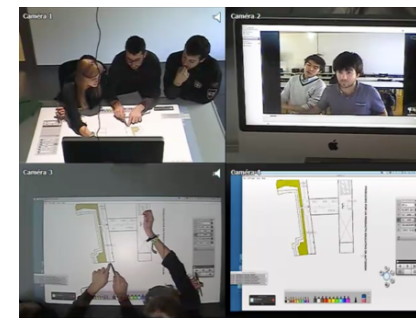


ENSA
Paris la Villette

LAB

Digital studios @ LUCID-ULg :

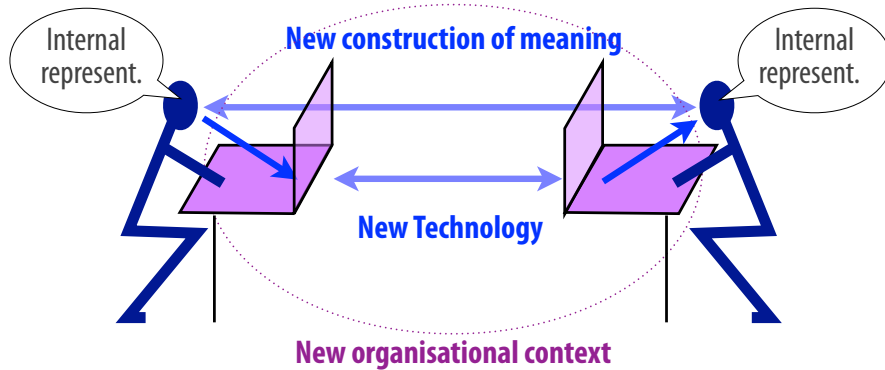
► Audio-video observation



► processing and analysing of hundreds of hours of video tapes / coding grids
(cf S. Ben Rajeb : collaboration analysis method and the "COMMON Tools")

LAB

Fundamental research : ARC COMMON 2011-2015



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#1 ADVANCED LEARNING

Expert consultation

► ULg student interviewing experts EM Ales



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#2 ADVANCED LEARNING

Collective design

► ULg students in architecture with ENSA Nancy students

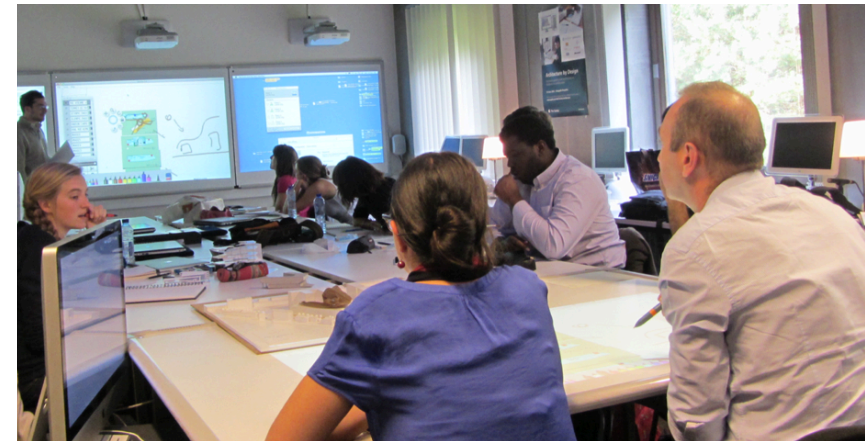


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#3 ADVANCED LEARNING

Collective project review

► in a co-presence meeting @ ULg



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#4 ADVANCED LEARNING

Public jury session

- ▶ with evaluators at ULg and distant evaluators at EM Alès

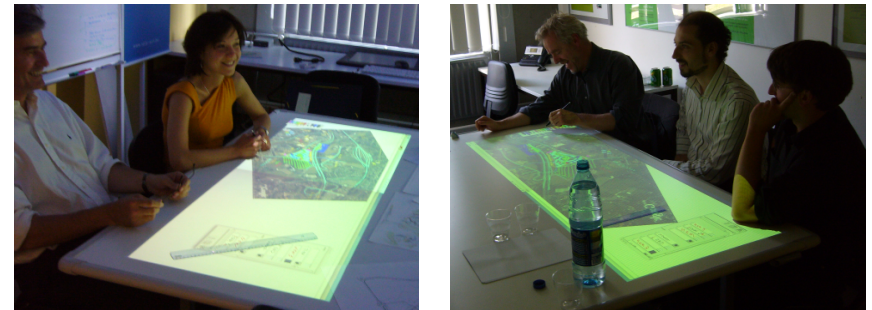


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#5 PROFESSIONAL PRACTICE

Collective design

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

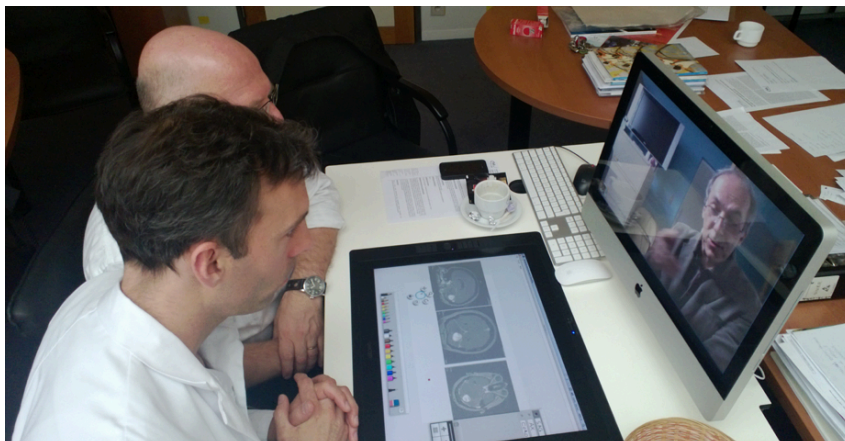


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#6 PROFESSIONAL PRACTICE

Consultancy between neuro-surgeons

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



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DISCUSSION

How do these new SAR configurations affect collaborative activities ?



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DISCUSSION

How do these new SAR configurations affect collaborative activities ?

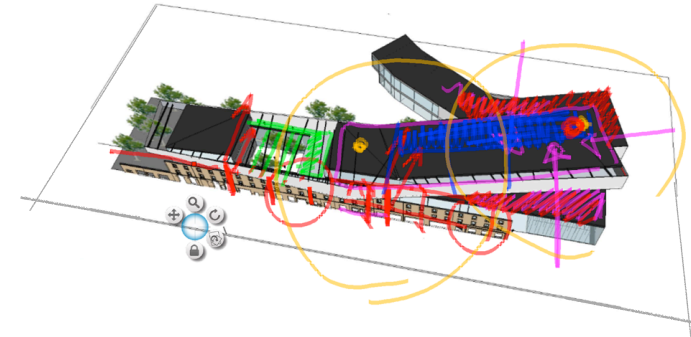
- ▶ emergence of new status
 - status of the document
 - status of relationship between actors
 - status of the collective workspaces
 - status of meetings

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STATUS OF THE DOCUMENT

Interactive shared artifact

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

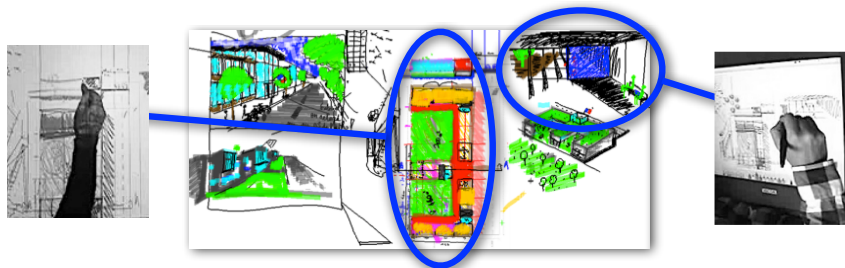


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STATUS OF THE DOCUMENT

Interactive shared artifact, drawn with "both hands"

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

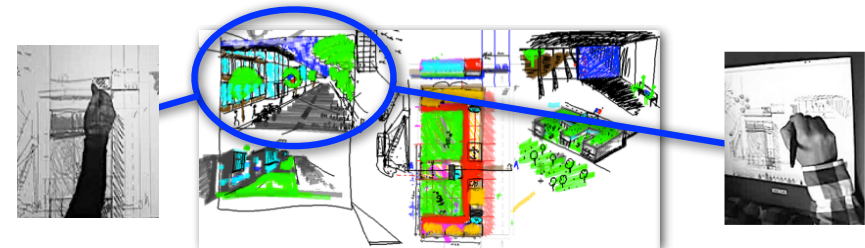


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STATUS OF THE DOCUMENT

Interactive shared artifact, drawn with "both hands"

- ▶ new ways to draw one common sketch created by two hands

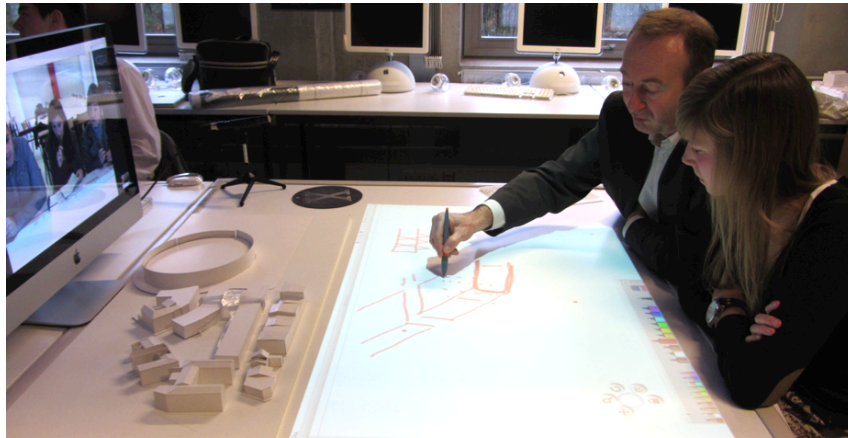


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STATUS OF RELATIONSHIP BETWEEN ACTORS

Interactive shared artifact

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

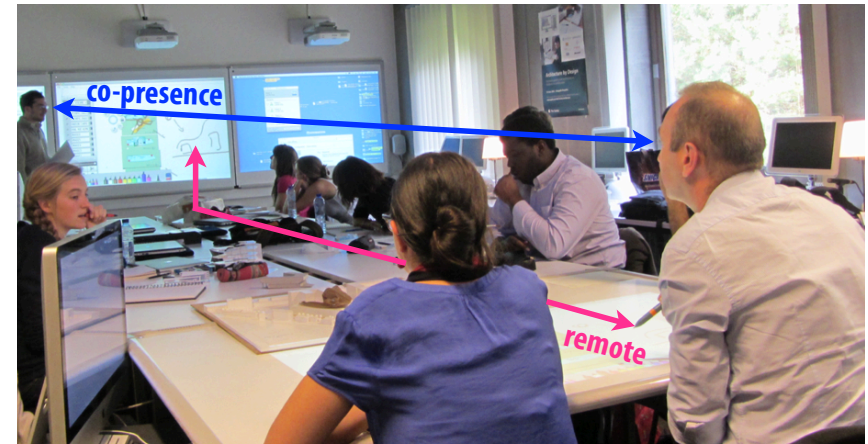


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STATUS OF THE COLLECTIVE WORKSPACES

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

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



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STATUS OF THE COLLECTIVE WORKSPACES

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

Collaborative contexts	Same time		Different time
Same place	Real presence	Augmented presence	Asynchronous exchange
Different places	Virtual co-presence		Remote asynchronous exchange

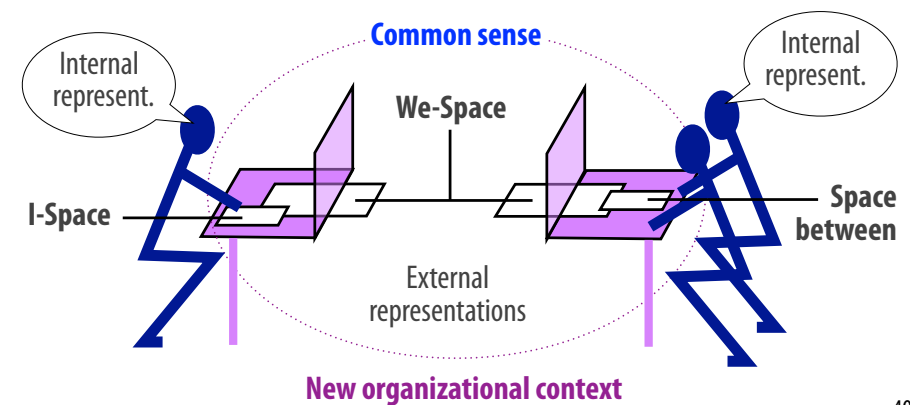
[Ben Rajeb & Leclercq 2014]

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STATUS OF THE COLLECTIVE WORKSPACES

Focus on collaborative design spaces

- ▶ 3 kinds of work spaces : I-Space, We-Space and Space-between



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STATUS OF MEETINGS

Professional practice : new types of collaborative work meetings

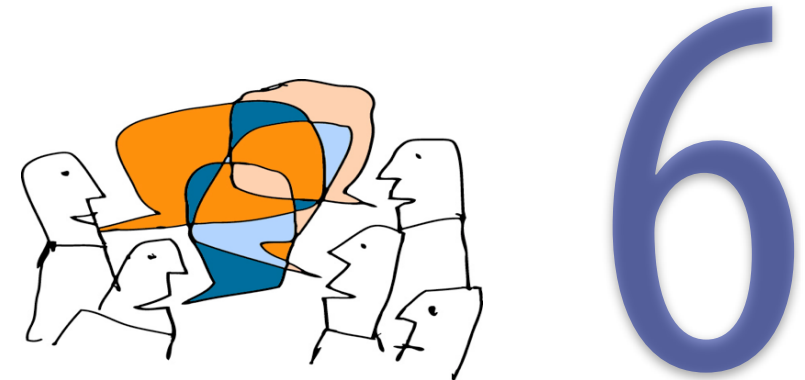
► example :

GSK [Brussels] - Jacobs [Paris] : 3 months of meetings observation	71
short appointments (< 15')	13
Appointments (< 30')	19
Short meetings (< 45')	15
Meetings (< 1h)	7
Long meeting (< 2h)	12
Very long work meeting (> 2h)	5
Duration of longest observed meeting	3h19'
Mean duration of observed meetings	39'
Mean number of weekly meeting	6

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CONCLUSION

Contributions of SAR configurations to collaborative activities

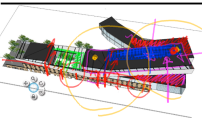





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CONCLUSION

Contributions of SAR configurations to collaborative activities

► From a large experimental panel :
4 collaborative tasks x 4 spatial augmented realities x 3 application fields

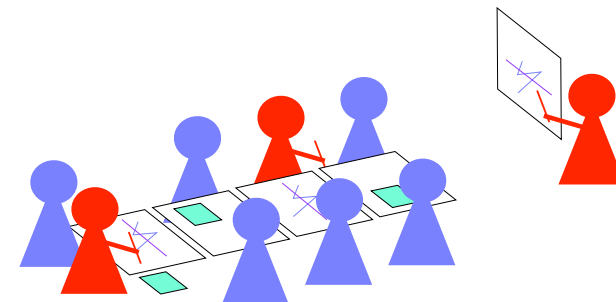
Documents status	Relationship	Workspaces status	Meetings types
			
Redefinition of the concept of shared document	Re-balancing of relationships between collaborators	New concept of integrated presence in the augmented space	New types of collaborative distant exchanges

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CONCLUSION

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



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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?

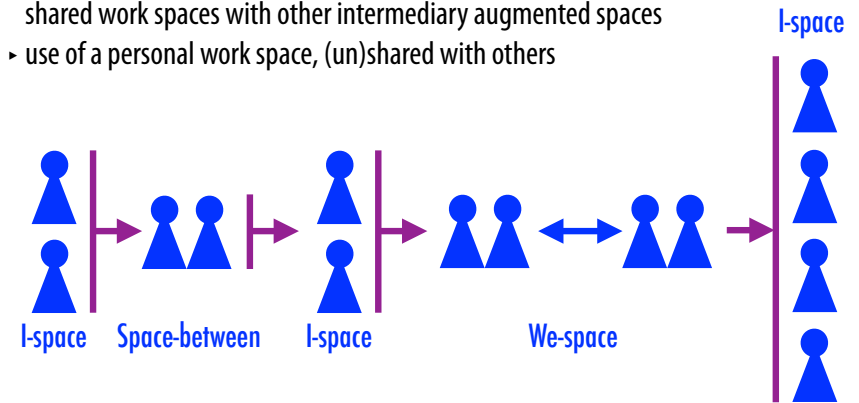


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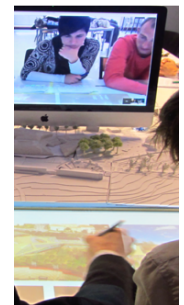
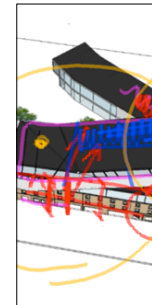


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References

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- ...

THANK YOU



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