

# 9 Cooperative Learning

9.1 Groups, Communication, and Collaboration

9.2 CSCW and CSCL

9.3 Virtual cooperative learning environments

9.4 Physical cooperative learning environments



9.5 Collaboration scripts in CSCL

## References:

J. Haake/G. Schwabe/M. Wessner (Hrsg.): CSCL-Kompendium, Oldenbourg 2004 (Kap. 2.1.5)

# Computer-Support in Physical Learning Rooms

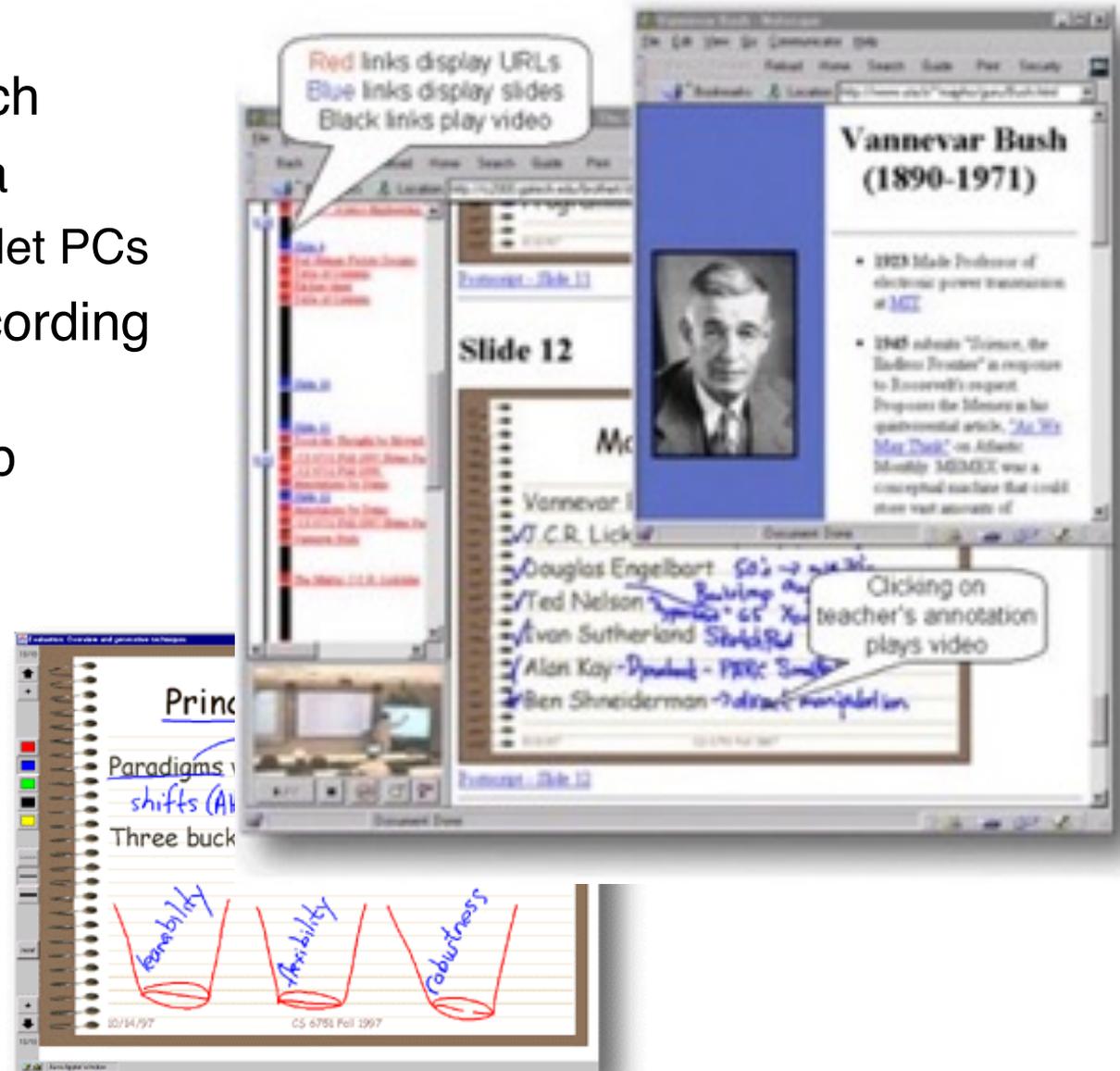
- Main scenarios:
  - Enhanced classroom
    - » Learners and tutor(s): at the **same time** in the **same room**
    - » Electronic aids to improve
      - presentation
      - communication
      - documentation
  - Distributed enhanced classroom
    - » Learners and tutor(s): at the **same time** in **different rooms**
    - » Various segmentations into groups possible
    - » Telecommunication is used to link rooms and to create “tele-presence”
- Possible roles of computer
  - Passive (pure support tool)
    - » E.g. slide presentation system, podcast recording and publishing
  - Active (guidance, partially replacing teacher)

# Basic Challenges for Learning Support

- Integration between social and technologically-mediated interaction
  - Not to replace but to enhance face-to-face communication
  - Not to inhibit face-to-face communication!
- Special features of computer-based working style in classroom:
  - Parallel work
  - Anonymisation of contributions
  - Structuring of process
  - Recording and playback
  - Interactive learning materials (e.g. simulations)
  - Automatic supervision of activities (e.g. in learning games).

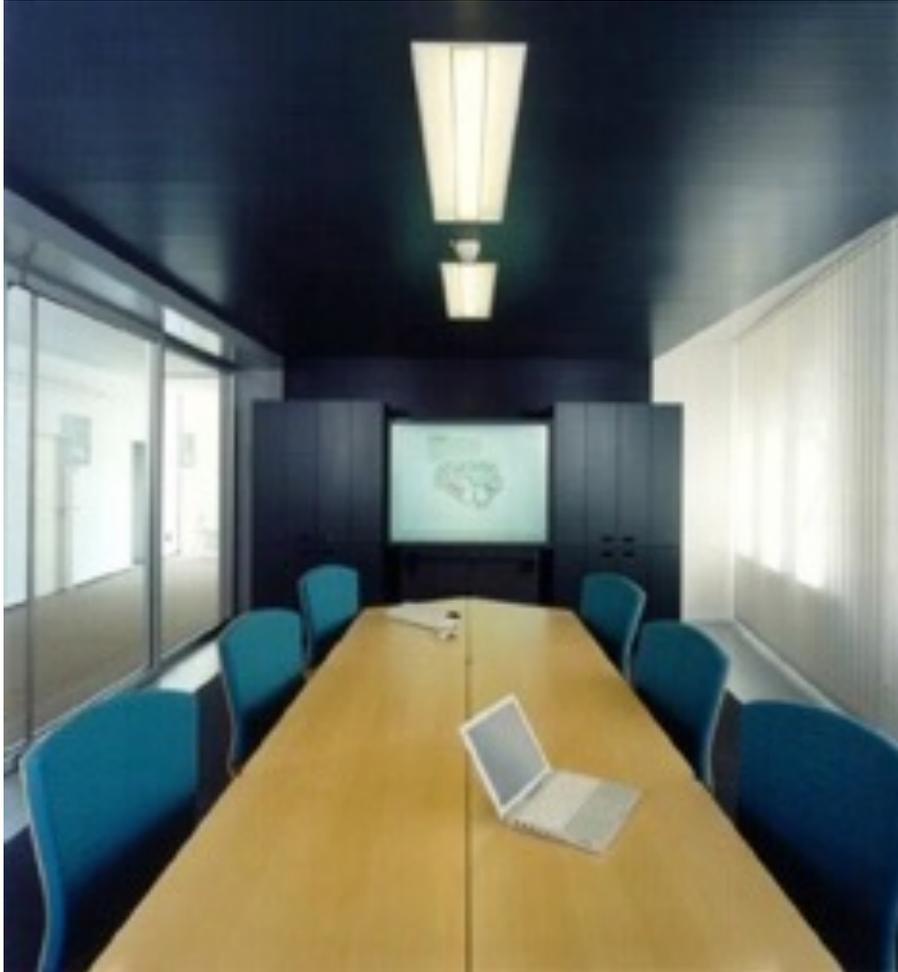
# eClass/Classroom2000

- Gregory Abowd, Georgia Tech
- Provision of electronic media
  - interactive whiteboards, tablet PCs
- Sophisticated automated recording (audio, video, pen strokes)
- Production of structured Web presentation



# Example of Enhanced Classroom

- CONCERT Lab (Fraunhofer IPSI), 2011



[http://www.ipsi.fraunhofer.de/concert/index\\_de.shtml?concert\\_lab/01\\_start](http://www.ipsi.fraunhofer.de/concert/index_de.shtml?concert_lab/01_start)

# Example for Integration of Handheld Devices (1)

- Concert Studeo (Fraunhofer IPSI)

## ConcertStudeo: Configuration & Usage Scenario

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The ConcertStudeo system includes:

### ConcertStudeo Board

Runs on the electronic blackboard,  
mainly used by teacher or tutor

### ConcertStudeo Control

Runs on each of the PDAs,  
used by the students

### ConcertStudeo Server

Runs on any PC, which is WLAN  
connected to ConcertStudeo Control  
and Board

### ConcertStudeo Weaver

Runs on the ConcertStudeo Board PC;  
is used to integrate interactions in  
advance or spontaneously ("on the fly") to  
already available learning content

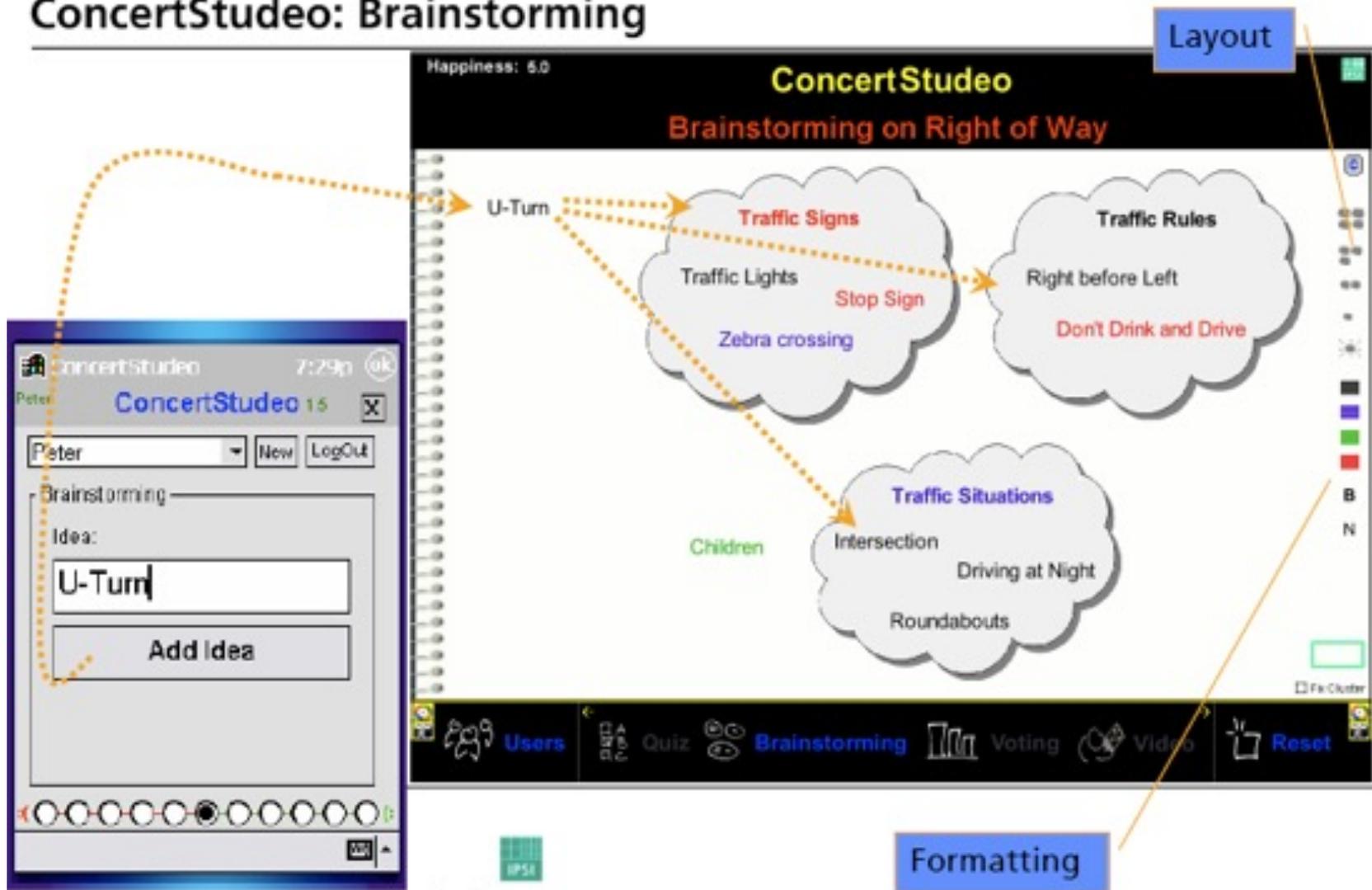


[http://www.ipssi.fraunhofer.de/concert/projects/past\\_projects/studeo/ConcertStudeo-englisch.pdf](http://www.ipssi.fraunhofer.de/concert/projects/past_projects/studeo/ConcertStudeo-englisch.pdf)

# Example for Integration of Handheld Devices (2)

- Concert Studeo (Fraunhofer IPSI)

## ConcertStudeo: Brainstorming



# Example for Integration of Handheld Devices (3)

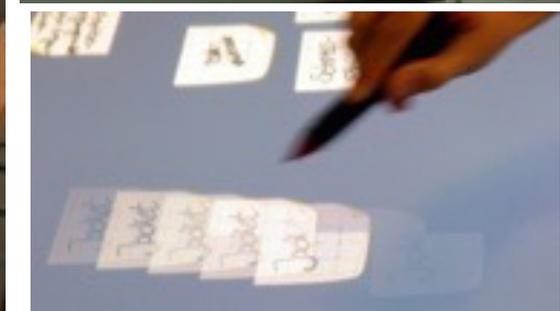
- Concert Studeo (Fraunhofer IPSI)

The image displays the ConcertStudeo application interface. The main screen shows a quiz question: "In which order do the road users have the right of way?" with a diagram of a four-way intersection. The diagram shows a yellow car at the top, a blue car at the right, a red car at the bottom, and a white car at the left. The intersection has four green traffic lights. Below the diagram, four options are listed: A (1st blue car, 2nd bus, 3rd red car), B (1st blue car, 2nd red car, 3rd bus), C (1st bus, 2nd blue car, 3rd red car), and D (1st bus, 2nd red car, 3rd blue car). A bar chart on the right shows aggregated answers for each option: A has 2 votes, B has 2 votes, C has 4 votes, and D has 0 votes. A blue box with an arrow points to the bar chart, containing the text "Aggregated answers are visualised".

The user interface on the left shows the user's name "Peter", the time "4:53p", and the application name "ConcertStudeo 1.5". Below this, there is a "Quiz" section with four options: A, B, C, and D. Option C is selected. There are "Clear Selections" and "Submit" buttons. At the bottom of the user interface, there is a progress indicator with 10 circles, the first of which is filled.

The bottom navigation bar of the application includes icons for "Users", "Quiz", "Brainstorming", "Voting", "Video", and "Reset".

# LMU Example: BrainStorm in Instrumented Room



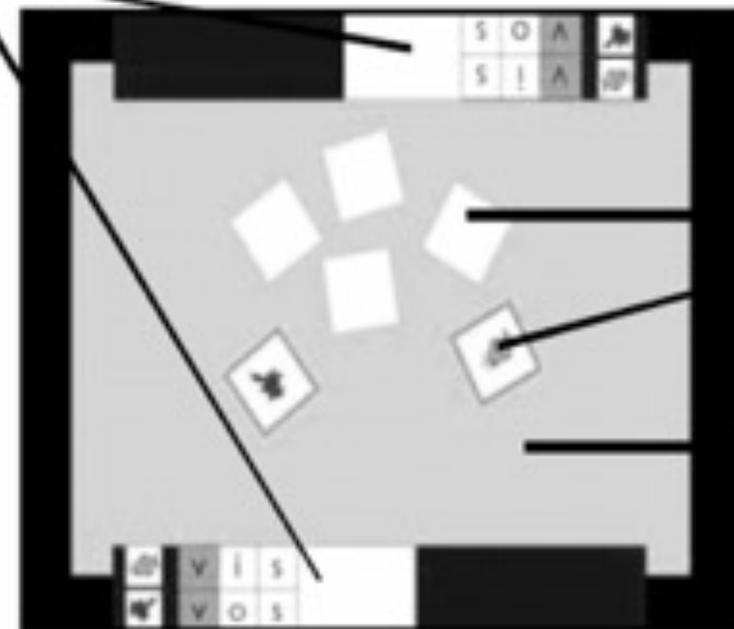
[Hilliges, Terrenghi, Boring, Kim, Richter, Butz 2007]

# Tangible Interaction in Learning Game: Example 1

- “Read-It” (Weevers, Sluis et al. 2004):  
Memory game for children who learn to read, multimodal



Personal  
workspace



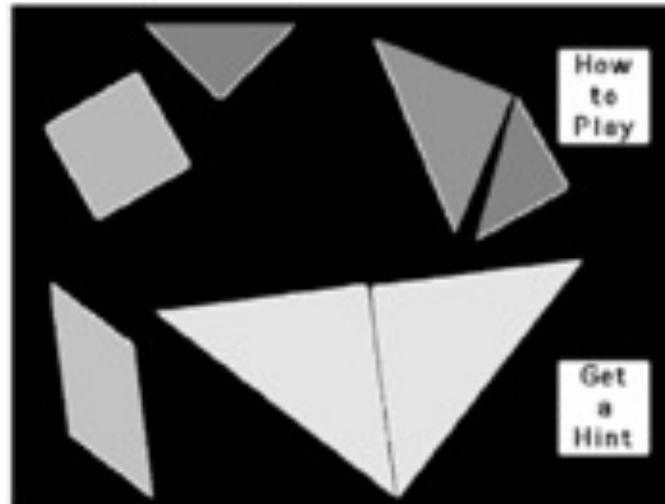
Virtual  
cards

Shared  
workspace

# Tangible Interaction in Learning Game: Example 2

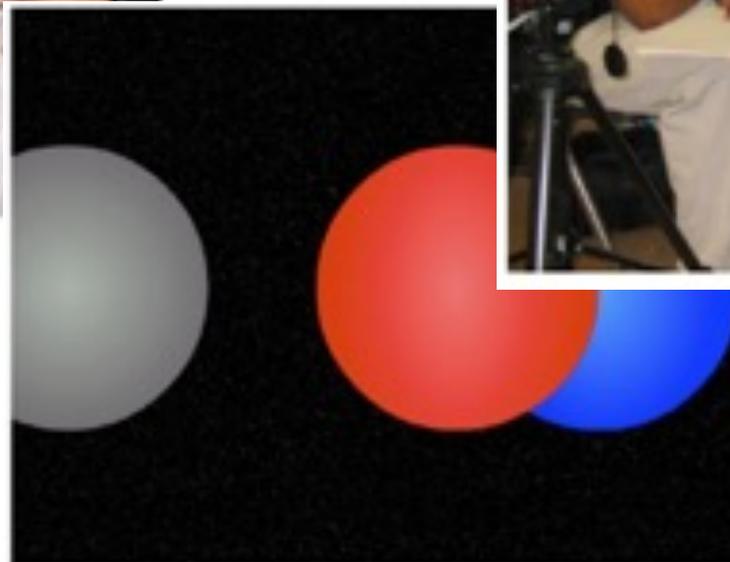


- Scarlatos 2002: Tangible Interfaces for Collaborative Learning Environments (TICLE)
  - Physical Tangram puzzle with computer assistance
  - Video-based tracking based on reflective patterns
  - Background problem analyzing process, adaptive to situation
  - User interface created with Macromedia Director



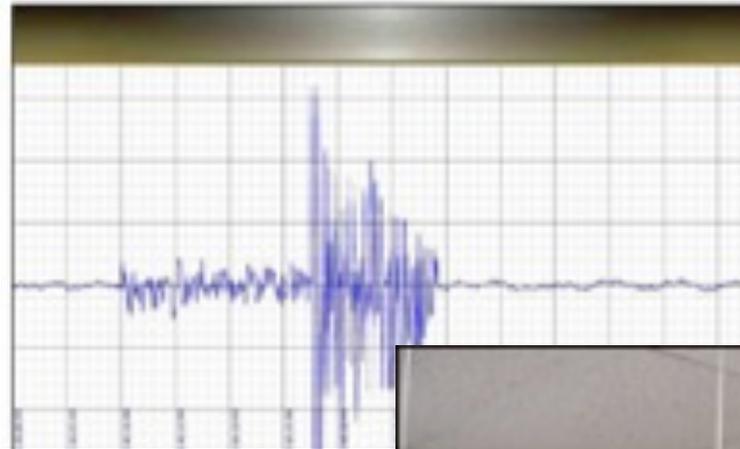
# Classroom-Embedded Simulation (1)

- Moher (2006)
- HelioRoom: Simulation of Solar System integrated into classroom



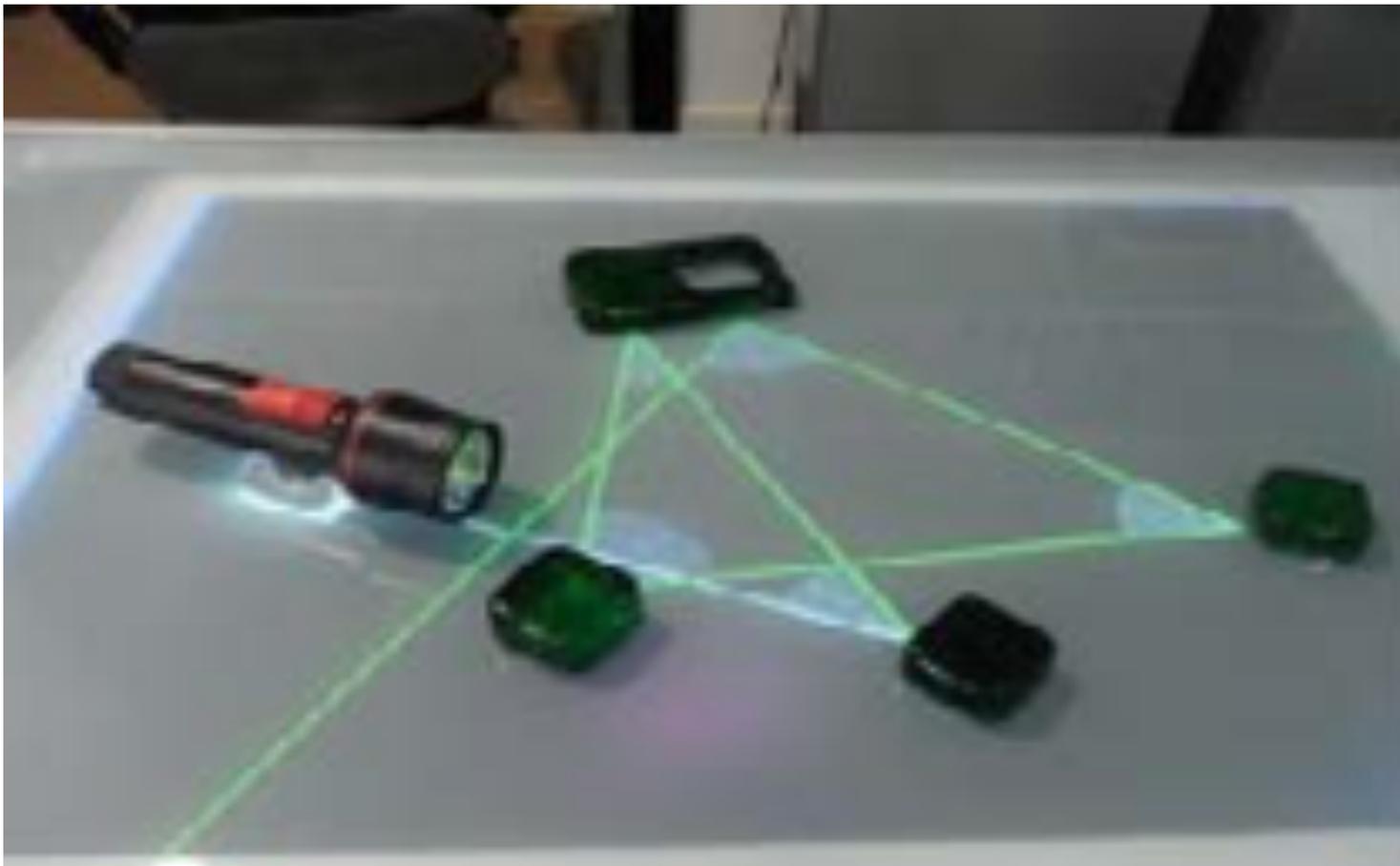
# Classroom-Embedded Simulation (2)

- Moher (2006)
- RoomQuake: Simulation of earthquake analysis integrated into classroom



# Tangibles for Controlling Simulation

- Falcão and Price, 2009:  
Exploring the physics of light



# Tangibles as Entry Points

- Entry points invite participation
- Experiment with 3 conditions
  1. Laptop (most constrained)
  2. Multi-touch tabletop
  3. Physical-digital setup with tangible entry points (least constrained)
- Collaborative design task (idea generation, planning, decision-making, ...)

## Physical-digital

- More equitable participation in terms of verbal utterances
- Participants who spoke the least
  - most physical actions
  - possible for more reticent members to utilize the tangible entry points



Rogers et al., 2009

# MultiSpace

- Multi-device environment
- Tabletop display as central hub
- Electronic content can be moved between tables and other devices.
- Focus group with TAs

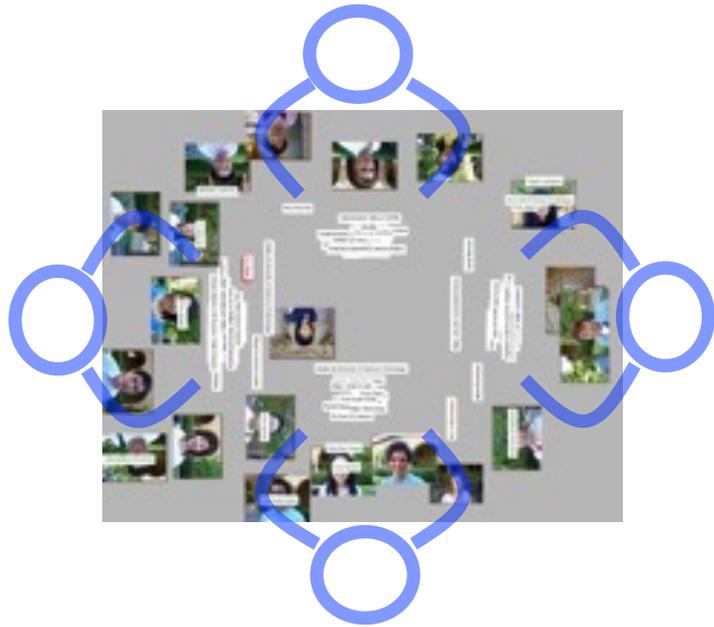


## Informal observations:

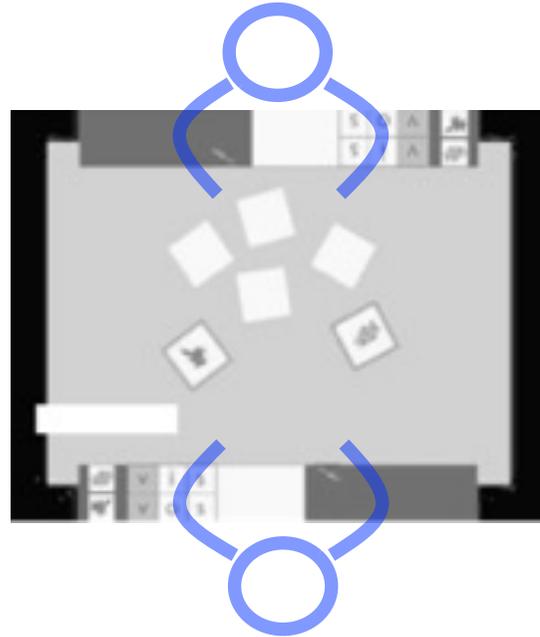
- Tabletops
  - More democratic collaboration
  - On the wall group control rarely changed
- Different devices for different tasks
  - Tabletop for layout and organization tasks (e.g. sort exam questions)
  - Wall was used for comparison tasks: Documents to the wall as a first step in collaboration...
- Supportive collaboration
  - Trouble on wall or tabletop → colleagues helped immediately
  - Trouble on laptop or tabletPC → no help

Everitt et al., 2006

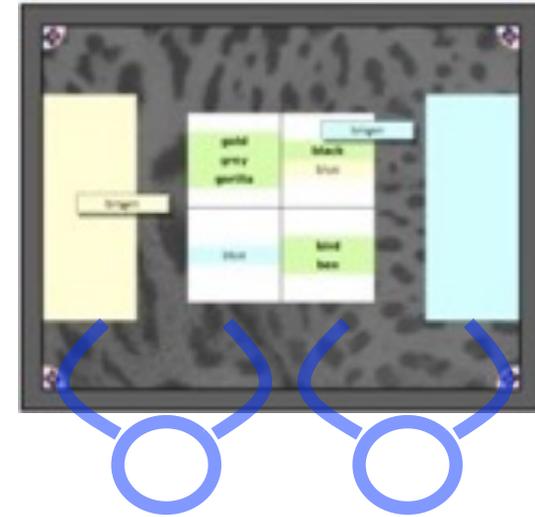
# Reading Text on Collaborative Displays



MatchingTable



Read-It



WordCat

- Seating arrangement has strong influence
  - on readability of text (various solutions possible)
  - also on the style of collaboration

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References:

F. Fischer, I. Kollar, H. Mandl, J. Haake (Eds.), Scripting computer-supported collaborative learning: cognitive, computational and educational perspectives. Springer, New York, pp. 101–115.

# What is a Script?

- “[...] a script is a story or scenario that the students and tutors have to play as actors play a movie script” (Dillenbourg, 2002)
- Example: Restaurant Script
- Term comes from cognitive psychology (Schank, Abelson 1977)
  - Knowledge structure regarding a sequence of actions
- Scripting in E-Learning involves three perspectives
  1. Cognitive psychology
    - Internal: Script is a memory structure inside the user
  2. Education
    - External: script is imposed on the user
  3. Computer science
- Joining in cognitive processes: thinking, learning
- Joining in metacognitive processes: monitoring, regulating, evaluating, ...

(King, 2007) (Dillenbourg, 2002)

# Specifying CSCL scripts

## Components:

1. Participants (number, demographics, ...)
2. Activities (summarizing, explaining, reviewing, ...)
3. Roles (listener, summarizer, ...)
4. Resources (e.g. teaching material)
5. Groups (how to divide the participants into groups)

## Mechanisms:

1. Task distribution (e.g. distribute material/information)
2. Group formation (by some principle vs. natural groups, e.g. gender)
3. Sequencing (order of events and activities)

(Kobbe, 2007)

# Taxonomy of Scripts

- Macro scripts vs. micro scripts

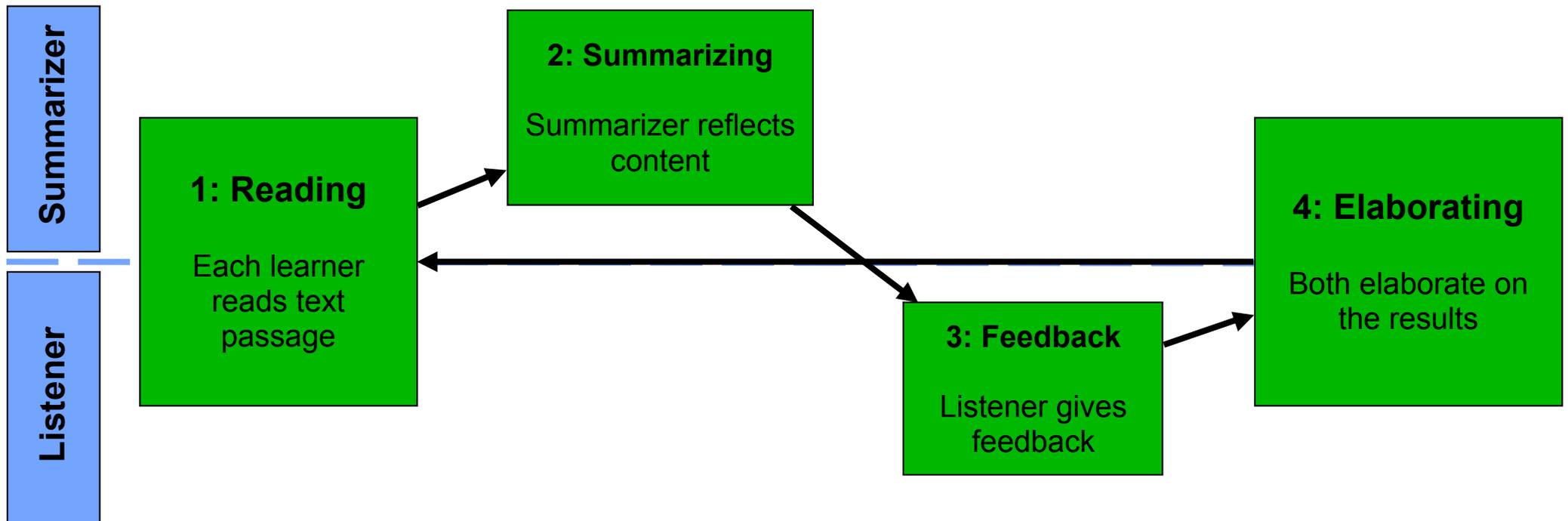
	Macro Script	Micro Script
Approach	Top-down	Bottom-up
Perspective	Pedagogical	Psychological
Level	Processes	Dialogues
Example	Structure of the collaboration process (e.g. presentation, discussion, ...)	Coordination of the collaboration (e.g. argument, counter argument, ...)

- Imposed vs. induced
  - Imposed means the script is explicitly shown to the user
  - Induced means it is embedded in the learning environment → higher freedom

(Kobbe, 2007), (Dillenbourg & Jermann, 2007), (Ayala, 2007)

# Example Macro Script: M.U.R.D.E.R.

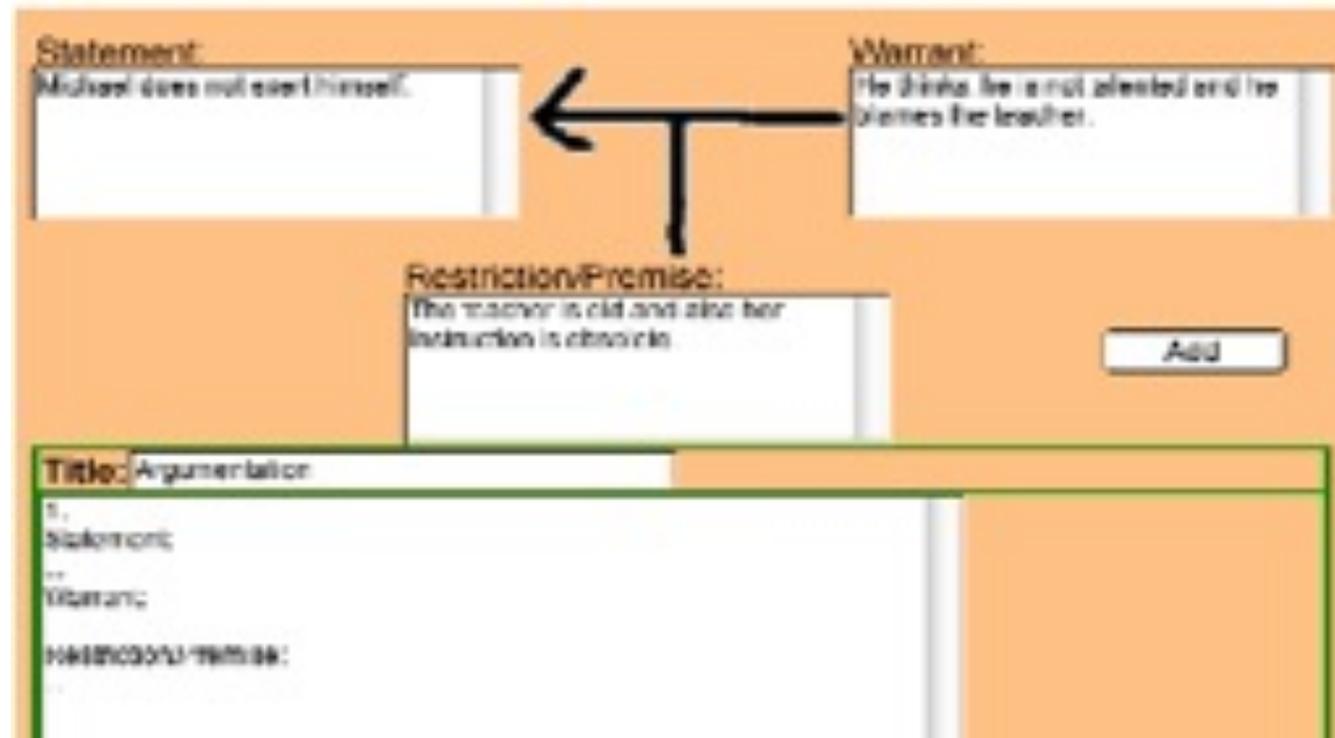
- Mood, Understanding, Recall, Detection, Elaboration, Review
- Supports collaborative sessions aiming at text understanding
- 2 Roles:
  - Summarizer
  - Listener



(Kobbe, 2007), (Kollar, 2006)

# Example Micro Script

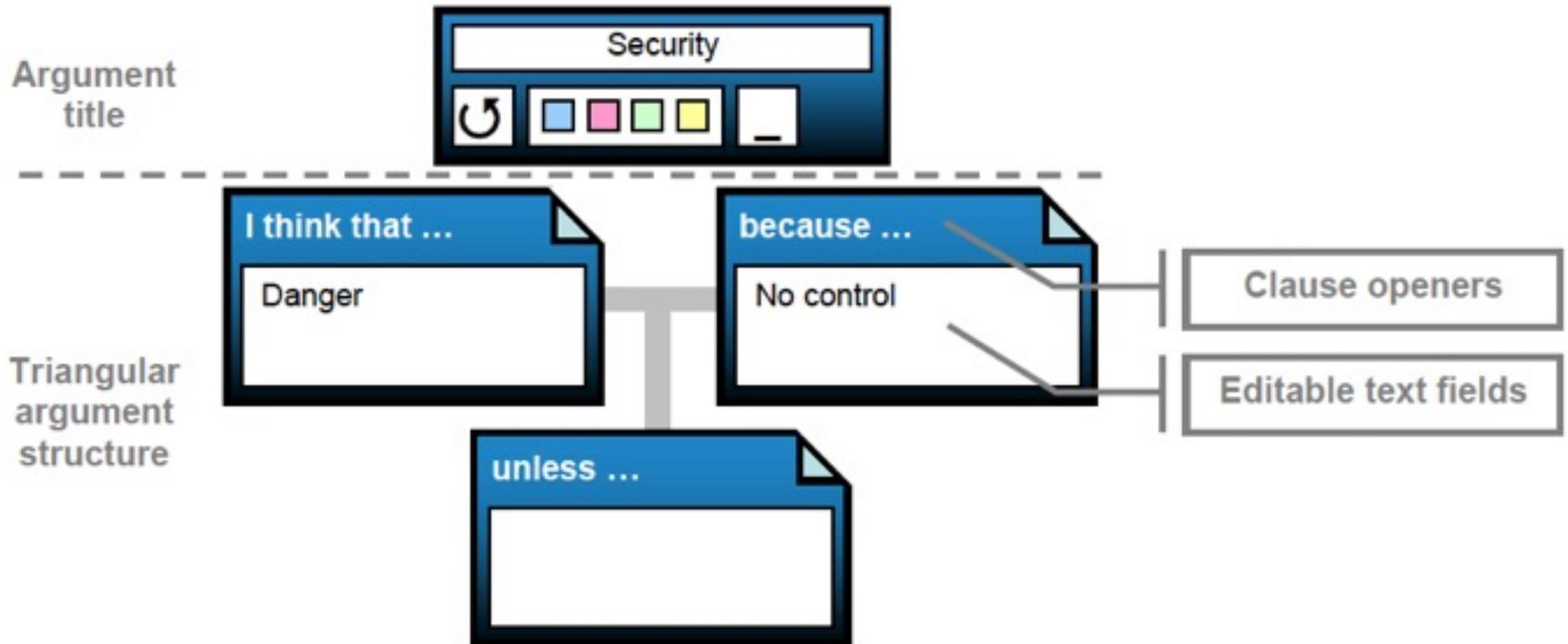
- Support the construction of
  1. Arguments (argument = statement + justification (“warrant”) + restriction)
  2. Argumentation sequences: (argument - counterargument - integration)



The interface of the script for argument construction (Stegmann, 2004)

(Stegmann, 2004)

# Argumentation Template for CSCL



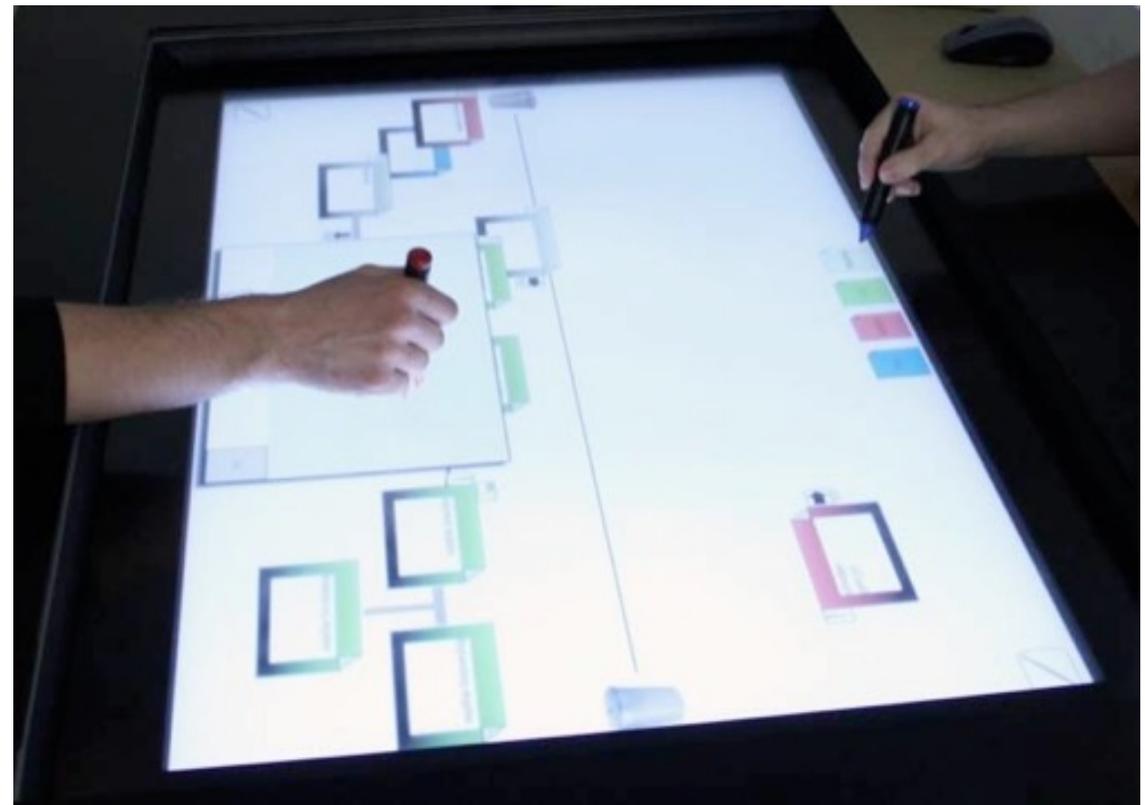
# Choosing a Display Environment for Argumentative Learning

Tabletop displays ...

- ... encourage eye contact  
→ support natural face-to-face communication [1]
- ... facilitate balanced participation [2, 3]

Problems:

- Orientation
- Text input



[1] Inkpen et al., 2005

[2] Rogers & Lindley, 2004

[3] Everitt et al., 2006

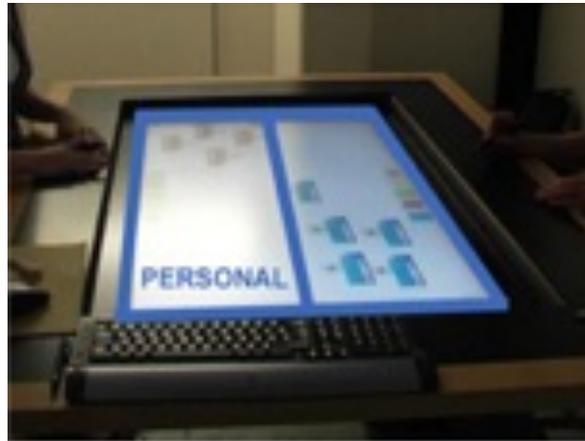
# Research on Alternative Display Configurations

1. Individual phase

2. Collaborative phase

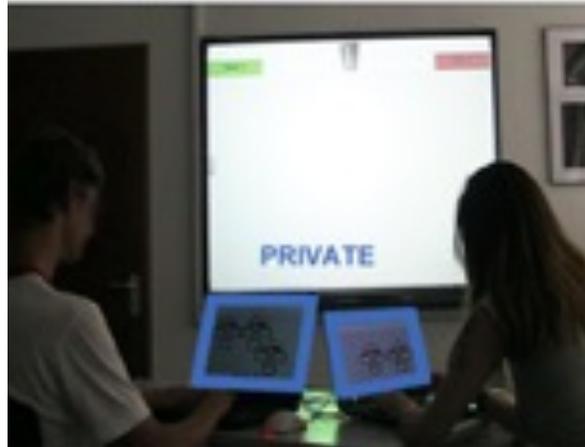
+ Increased awareness

ArgueTable

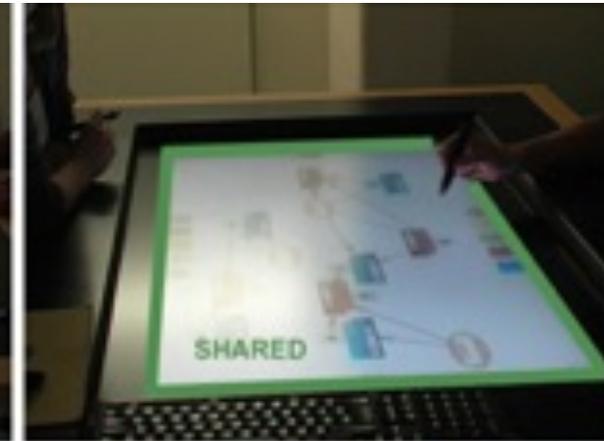


+ Less distraction

ArgueWall



+ Balanced role distribution

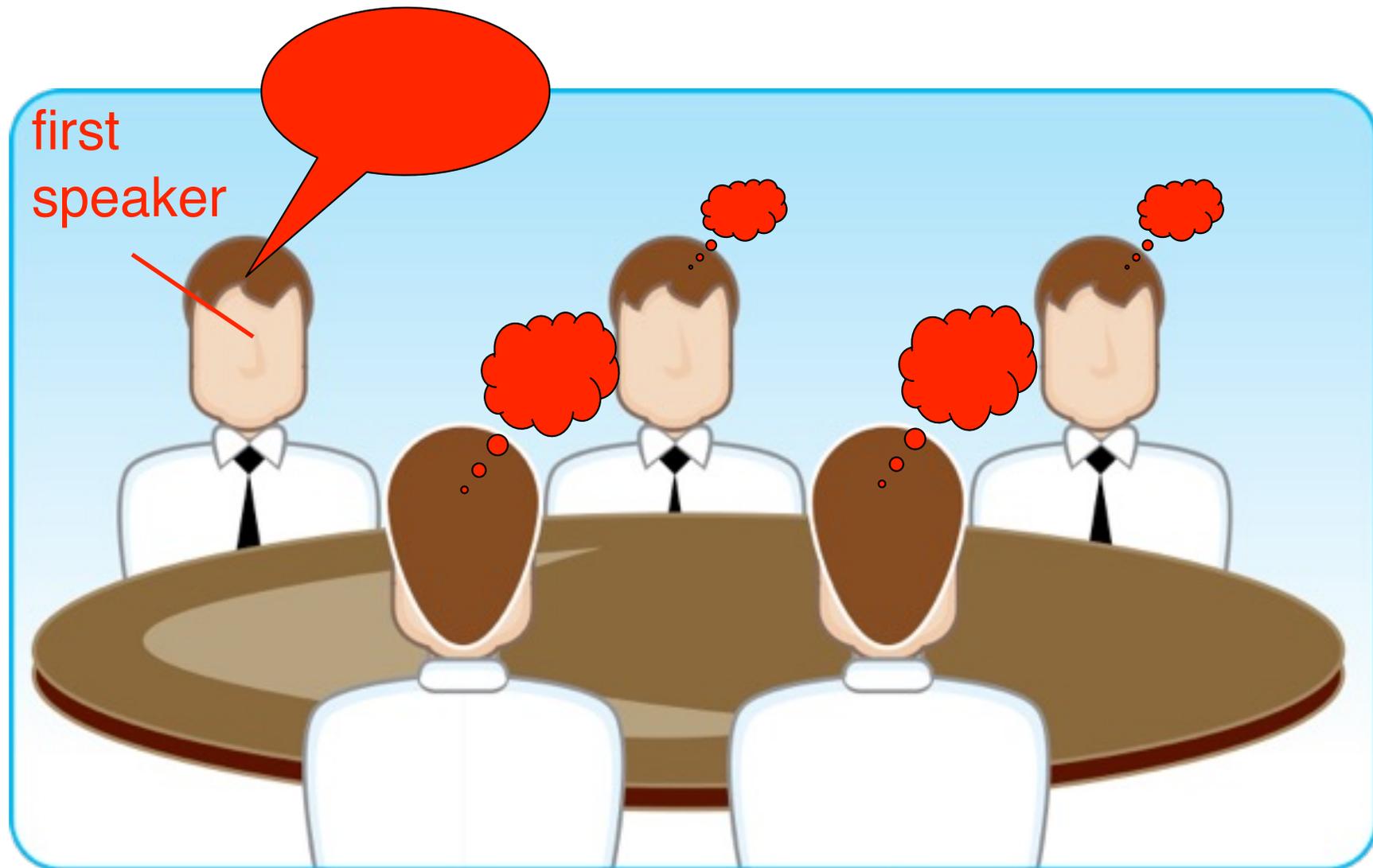


+ More sequences

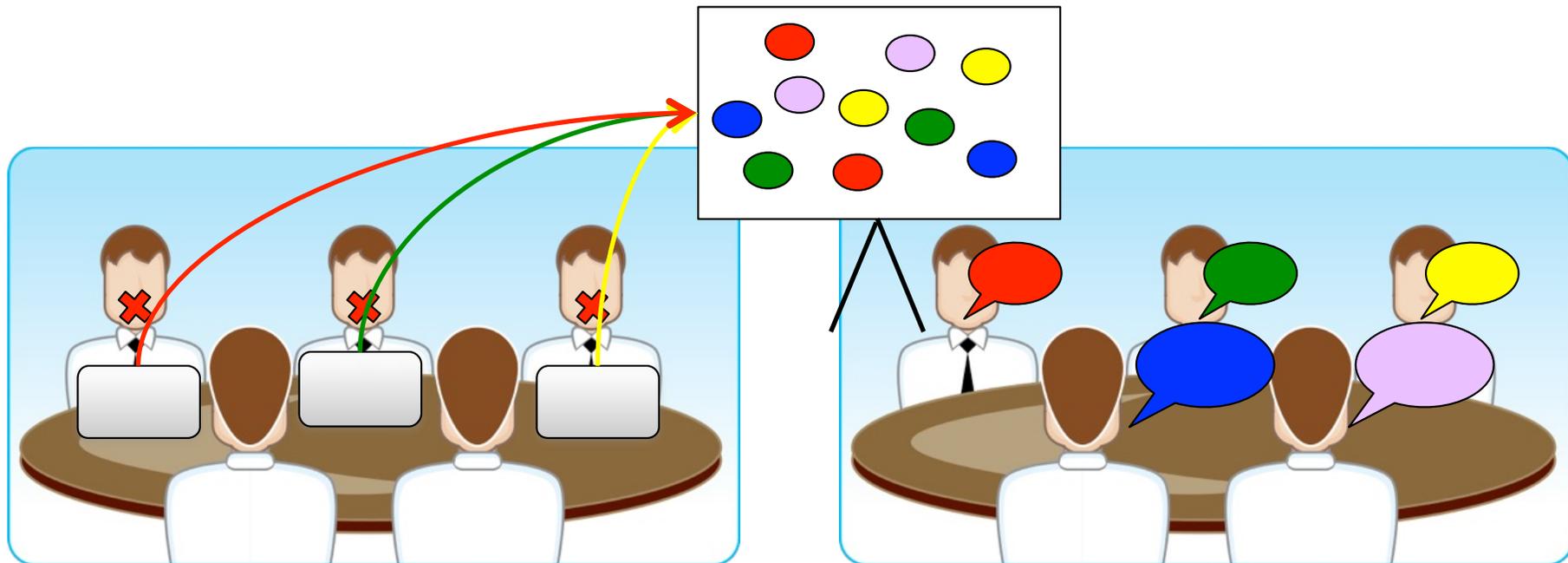


Sara Streng (LMU) et al., CSCL 2011: ArgueTable vs. ArgueWall

# Influence of the First Speaker



# Two Phases of Note&Share



## 1. Individual phase

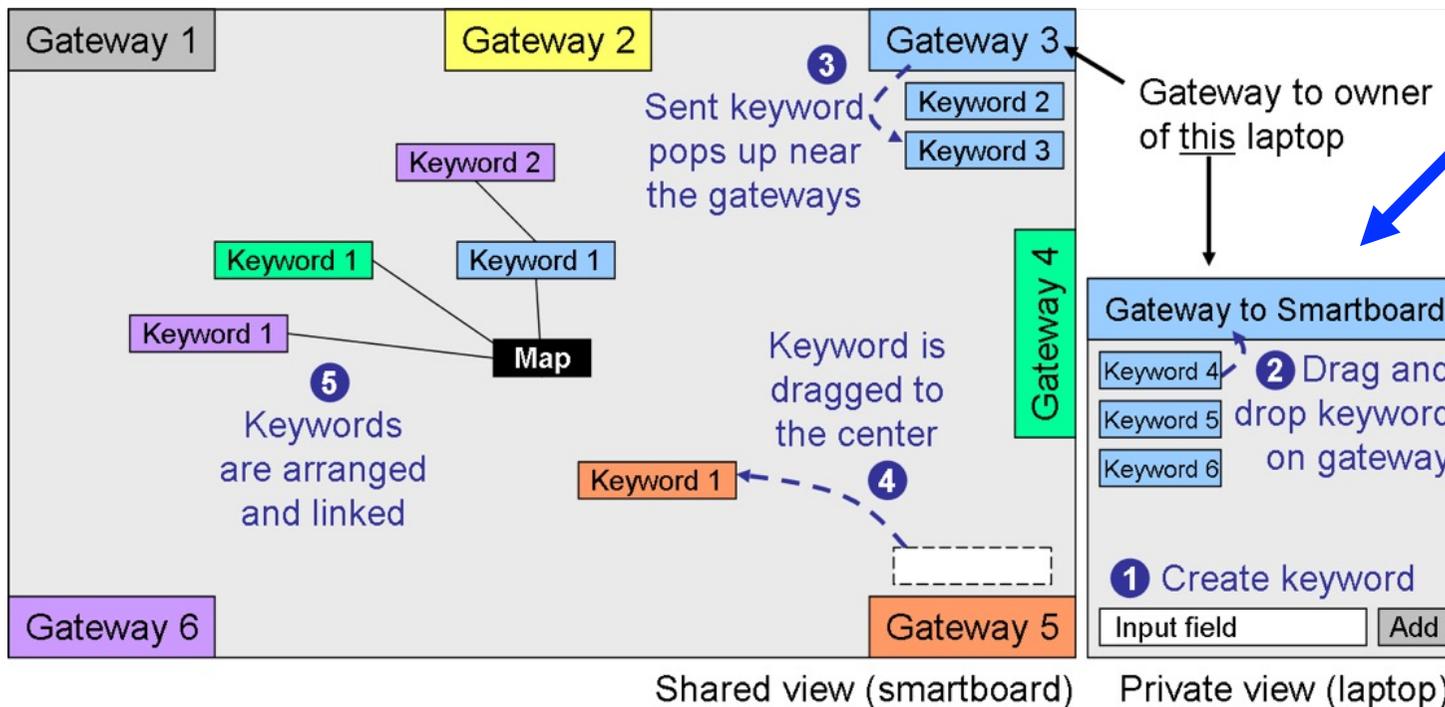
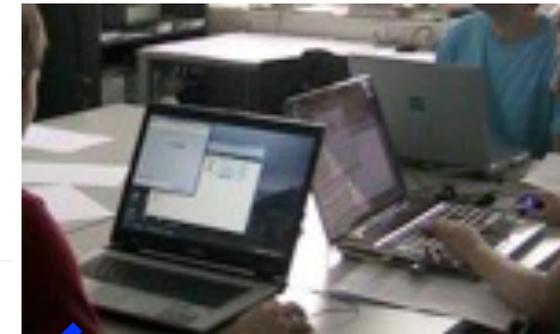
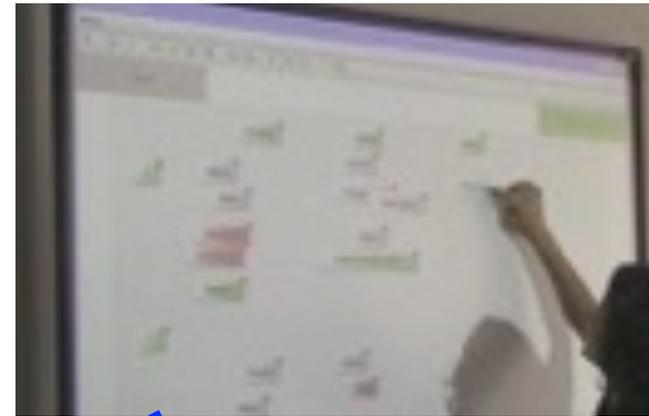
- Private workspaces
- Knowledge representations

## 2. Collaborative phase

- Shared workspace
- Knowledge sharing

# Note&Share

- Facilitate knowledge sharing:
  - Note:** Individually create keywords (laptops)
  - Share:** Transfer keywords to smartboard (gateway interaction technique)

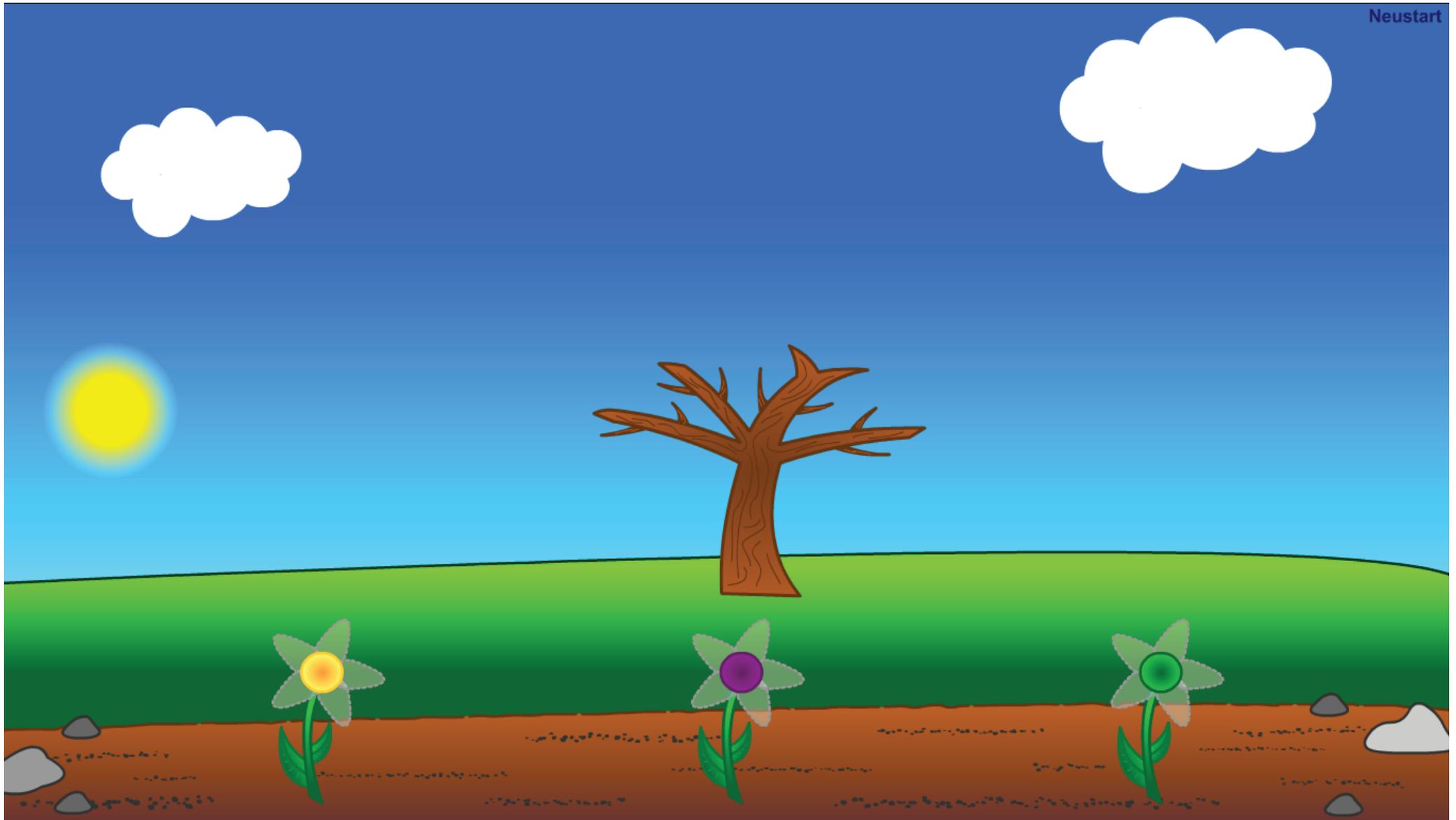


# Group Mirror for Brainstorming: Group Garden



# Groupgarden [Tausch et al, 2014]

Display in the beginning:



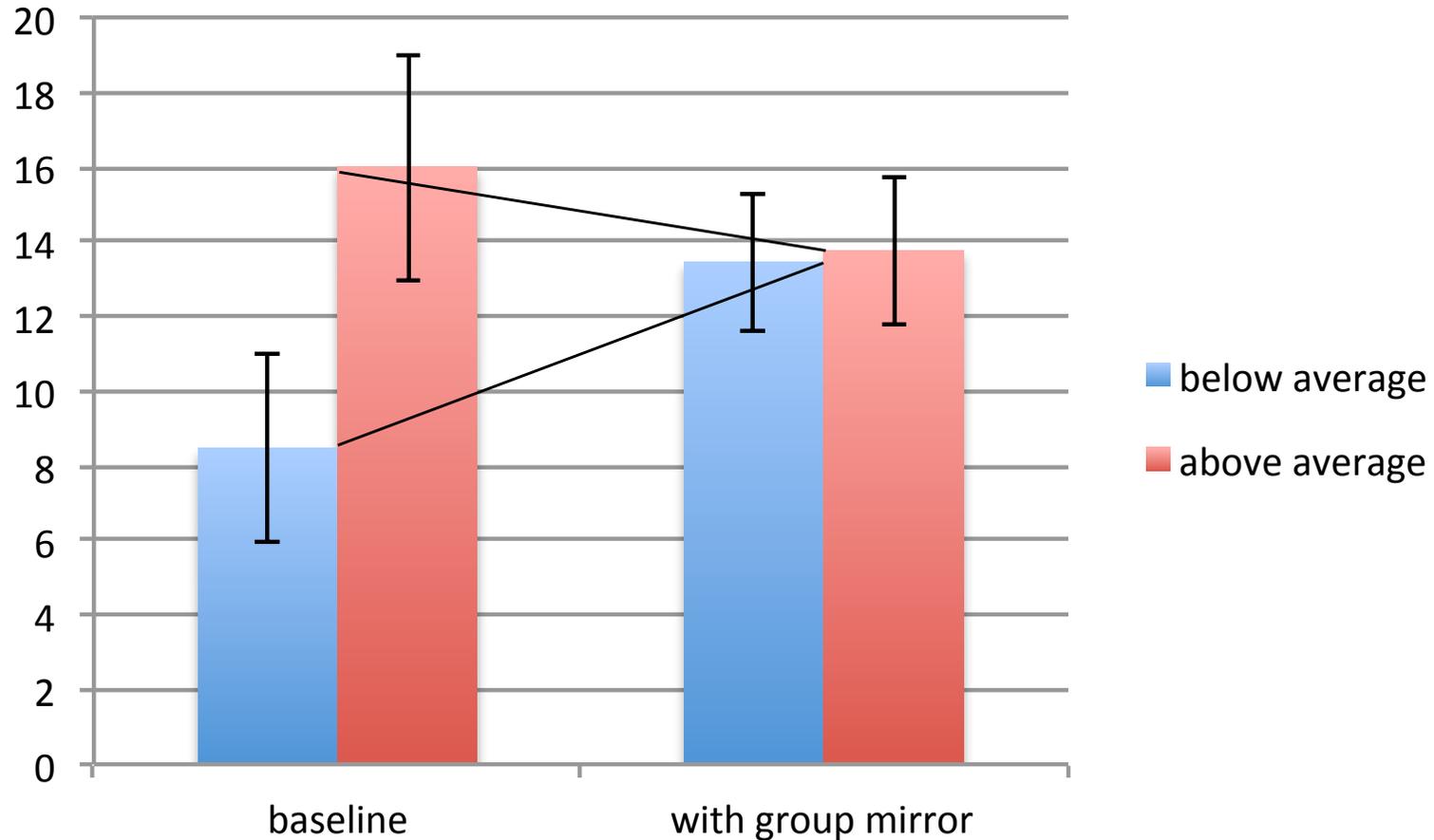
# Groupgarden [Tausch et al, 2014]

Focus on quantity and balanced participation:



# Groupgarden [Tausch et al. (LMU), NordiCHI 2014]

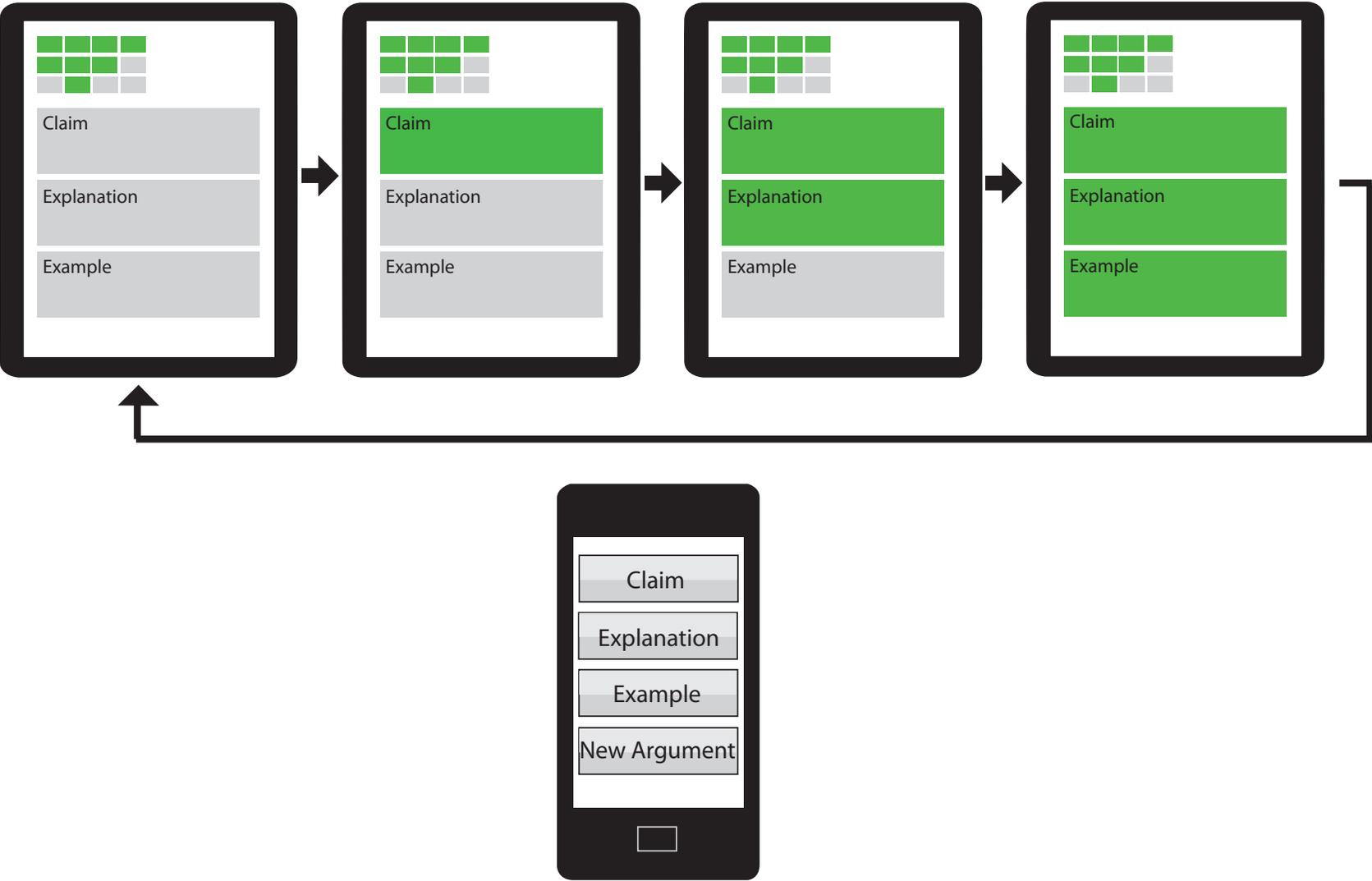
number of ideas



# Debate Feedback [Huber et al. (LMU), CHI 2014 Poster]



# Debate Feedback: Jury and Speaker Interfaces



# Debate Feedback: User Reactions [Huber et al, 2014]

- Feedback rated as helpful:
  - “immediate improvement”
  - “When all three parts are green, I receive an extra push, like a reward system”
- Negative remarks:
  - “sometimes distracting”
  - “too inflexible”
- Expert speakers confirm that the system is more appropriate for novices than experts:
  - “should be dispensable for a good speaker”



# Current Research on Group Feedback Technology: Peer Feedback with Light Objects [Sarah Tausch]



Group members can provide feedback to each other during argumentation