

# Chapter 3: Interactive Tabletops and Surfaces

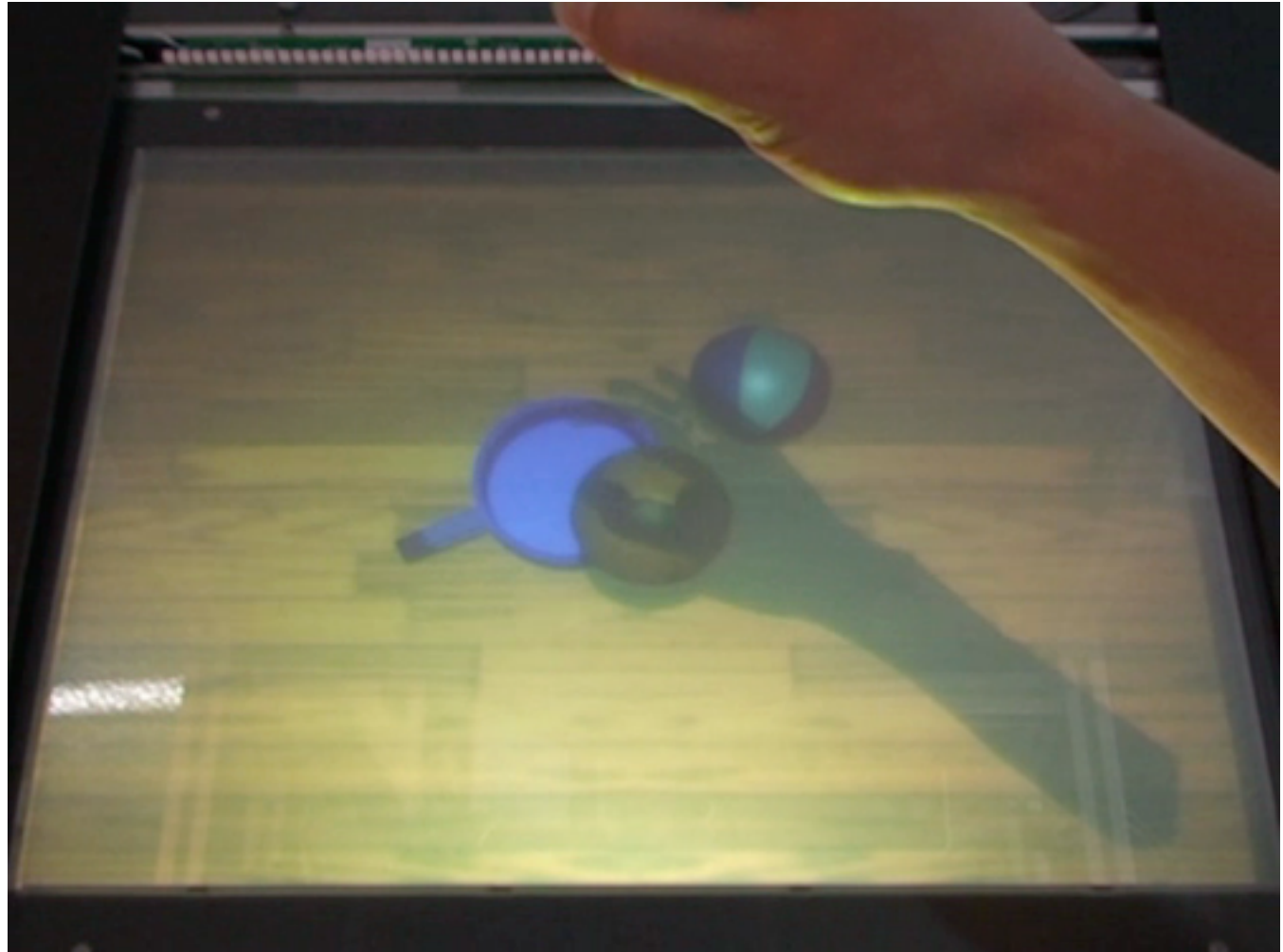
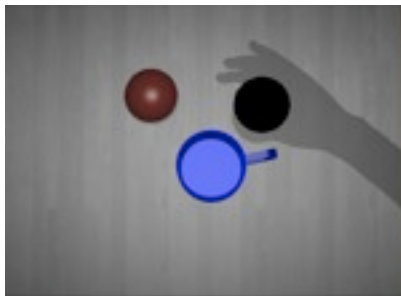
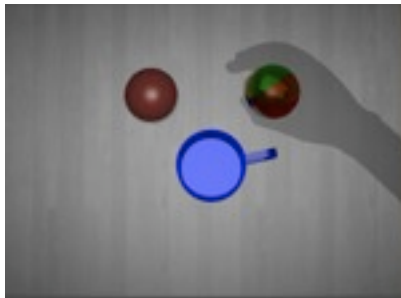
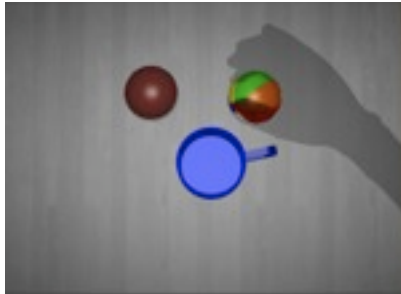
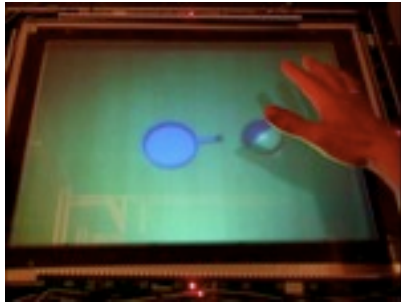
Vorlesung „Mensch-Maschine-Interaktion II“

Prof. Dr. Andreas Butz, Dr. Paul Holleis,

WS 2009/10

(slides today partly courtesy of Dr. Otmar Hilliges)

# Interactions in the Air (Hilliges 2009)

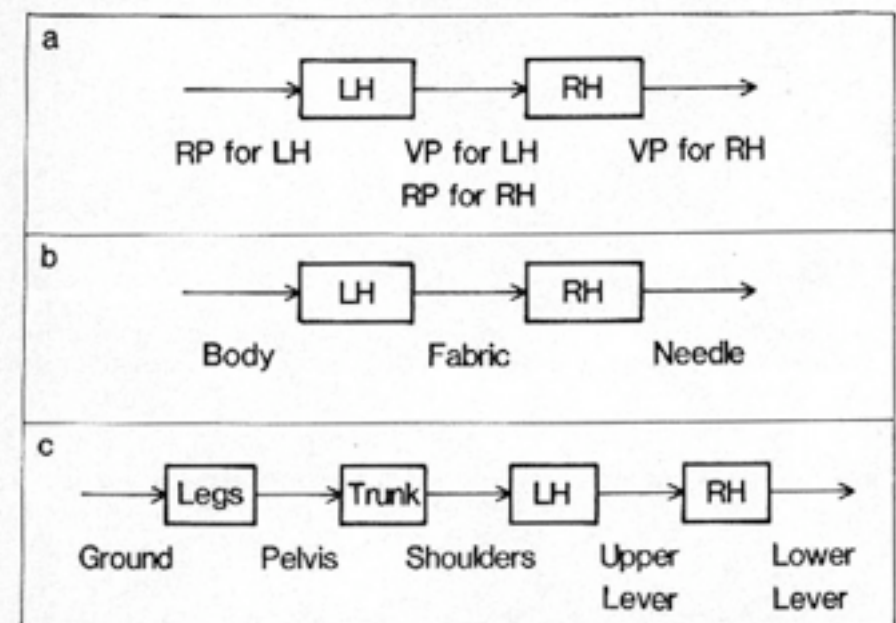
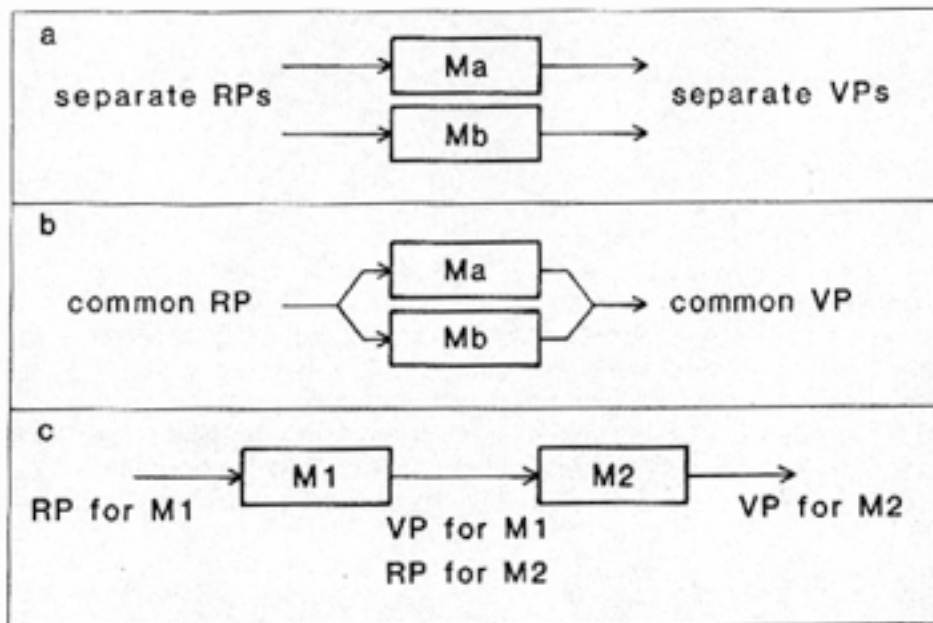


# Problems and Particularities

- Asymmetric bimanuality
- Territoriality on tables
- Direction and orientation on tables
  
- Occlusion Problem
- Fat finger problem

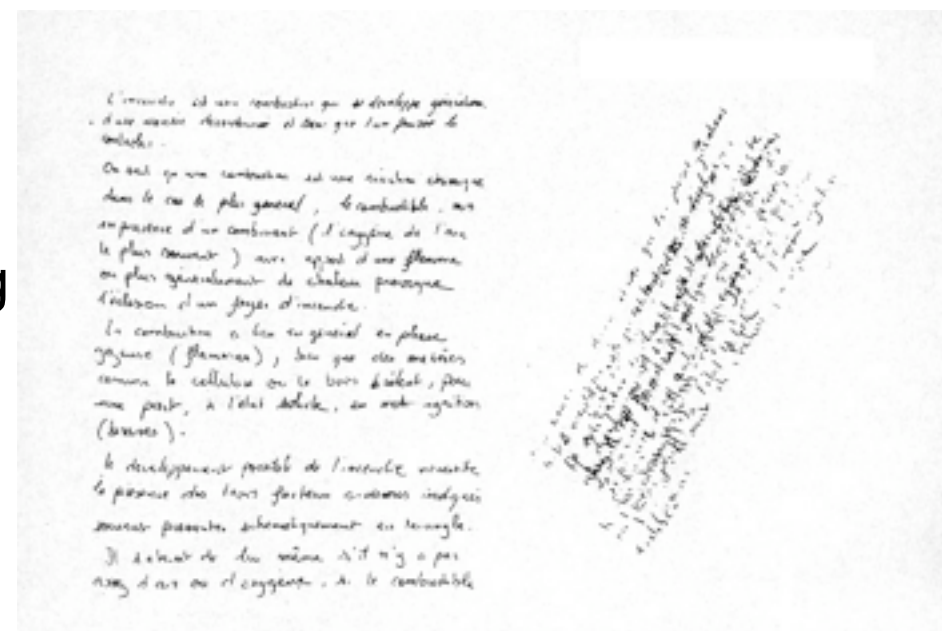
# Asymmetric Bimanual Interaction (Guiard 1987)

- Human bimanual interaction is largely asymmetric
- Hands are simply regarded as „motors“
  - Non-dominant hand provides a reference frame
  - Dominant hand interacts fine-grained in it
- In this sense, both motors form a logical chain



# Example: Handwriting

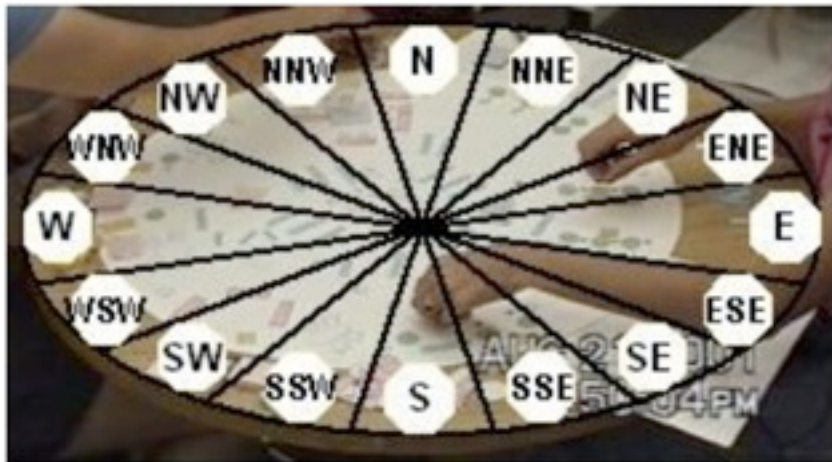
- Recordings of the same handwriting
  - relative to the sheet of paper
  - relative to the table (obtained with the help of carbon paper)



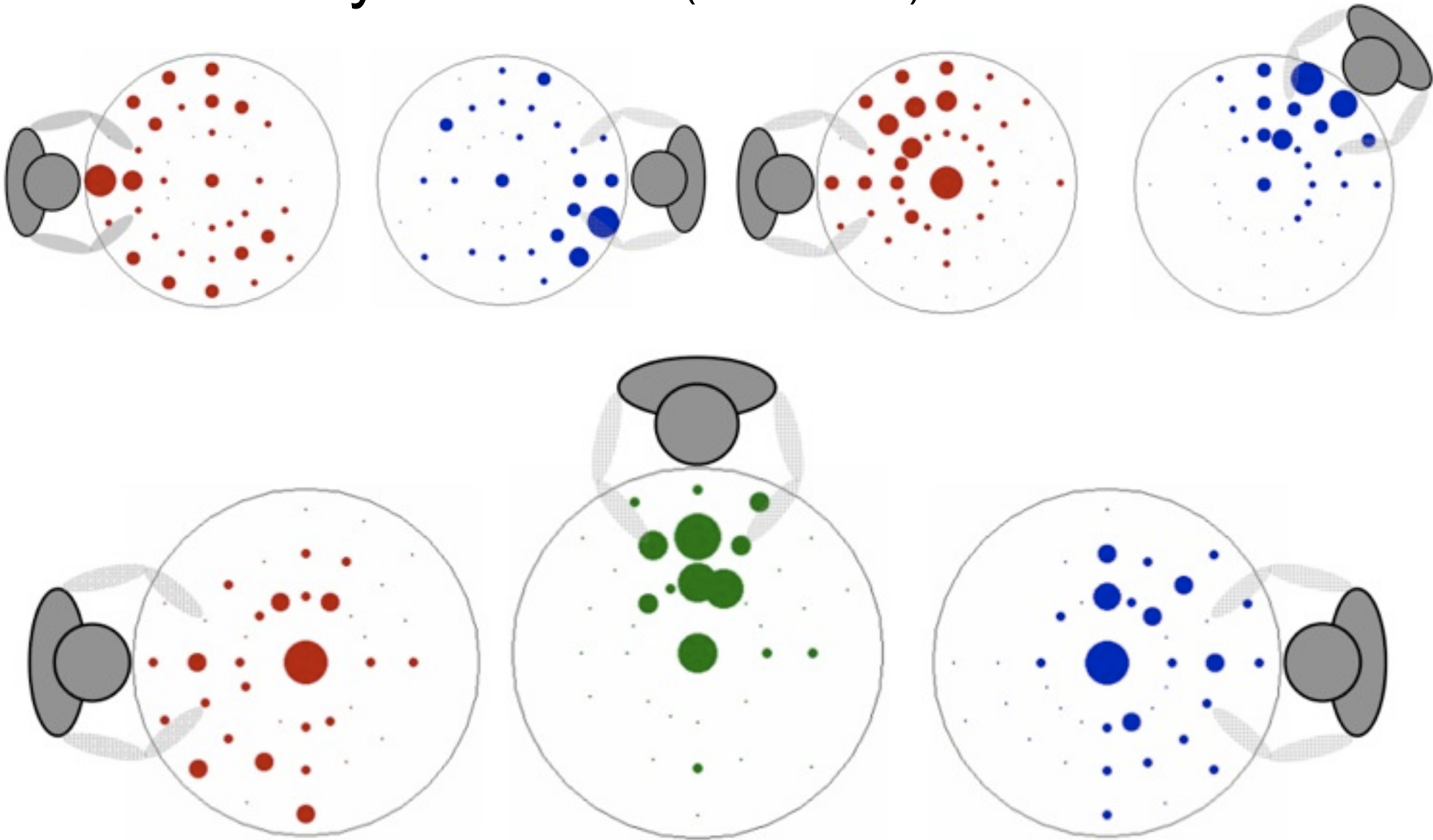
- Translation movements for writing lines were made obliquely on the table: slant of the paper
- Rectangle within which right-hand motion (relative to the table) was confined = roughly 1/3 of the page
  - Movement of the pen tip from the first to the last line (24 cm)
  - upward displacement of the page (16 cm)
  - downward displacement of the right hand (8 cm)

# Territoriality on tables (Scott 2004)

- Studies on how people use the space on a table
  - puzzle, game, Lego activities + room planning on round tables
- Different areas on the table surface
  - personal space (directly in front of person)
  - group space (reachable by all members)
  - storage space (in the periphery)
- Boundaries between areas are flexible



# Territoriality on tables (Scott 2004)



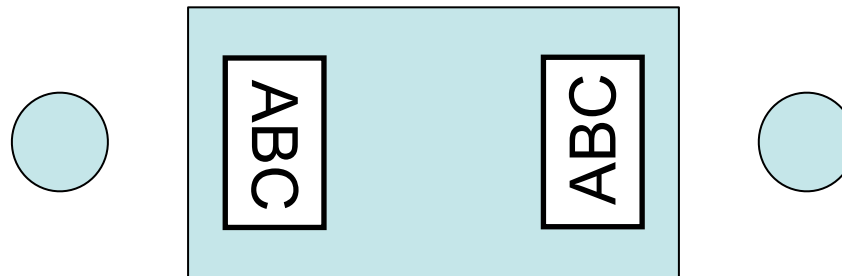
# Territoriality on tables (Scott 2004)

- Design Implications:
  - Provide visibility and transparency of action
  - Provide appropriate table space
  - Provide functionality in the appropriate locality
  - Allow casual grouping of items and tools in the workspace



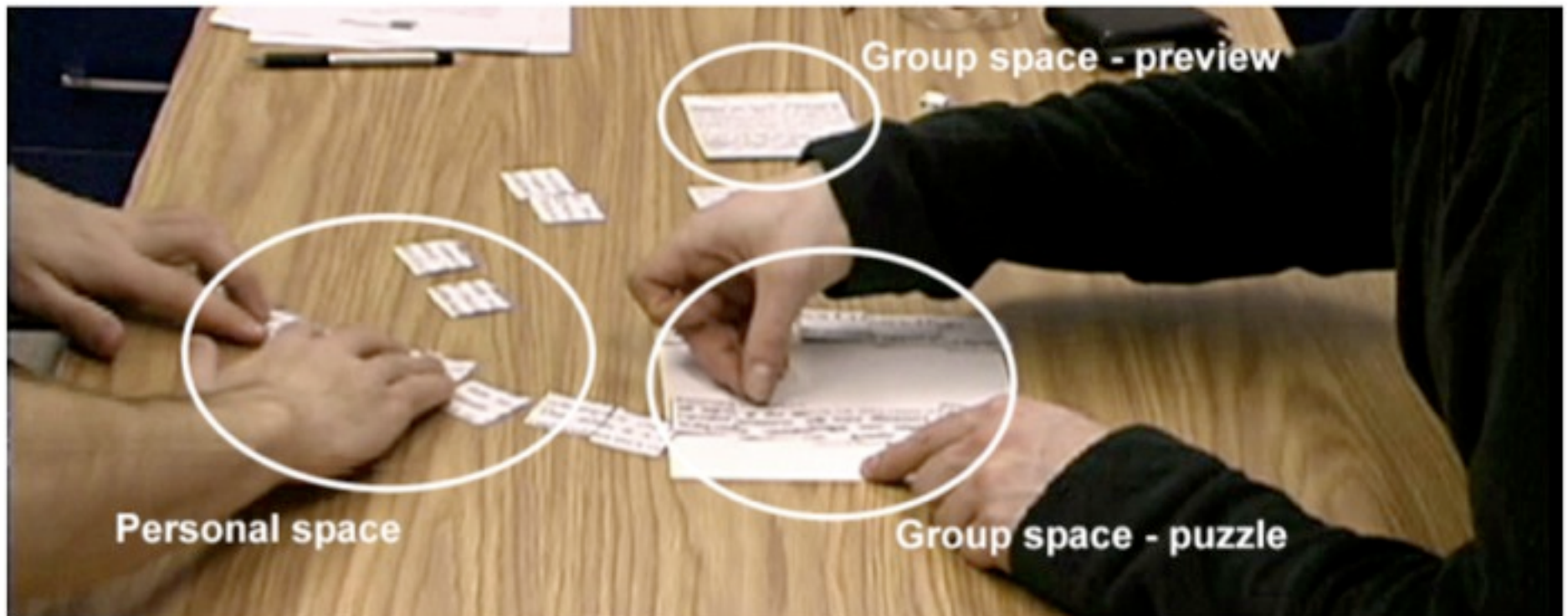
# Orientation on tables (Kruger 2003)

- Basic problem: no clearly defined „up“ direction when interacting with multiple users around a table
- Known approaches:
  - Fixed orientation
  - Manual orientation
  - Person-based automatic orientation
  - Environment-based automatic orientation



# Orientation on tables (Kruger 2003)

- Variant orientation can serve as a collaborative resource:
  - Using someone else's alignment conveyed support
  - Orientation could establish the intended audience
  - Orientation was also used to create a personal space.



# Orientation on tables (Kruger 2003)

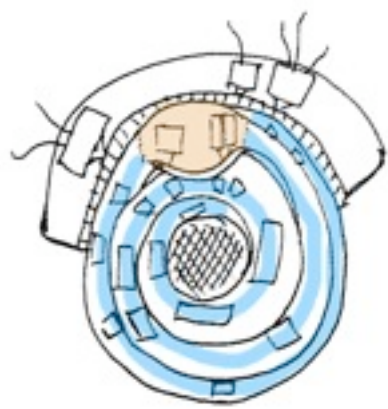
- 3 main roles of orientation:
- Comprehension
  - Ease of reading
  - Ease of task
  - Alternate perspective
- Coordination
  - Establishment of personal spaces
  - Establishment of group spaces
  - Ownership of objects
- Communication
  - Intentional communication
  - Independence of orientation

# Concept: Hybrid widgets

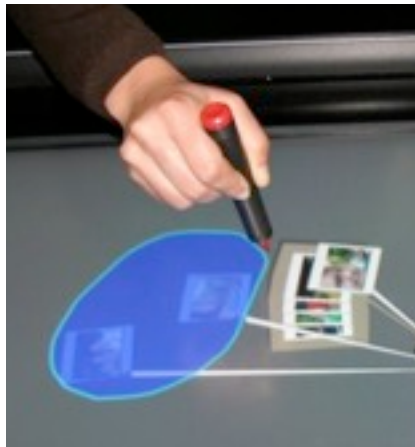


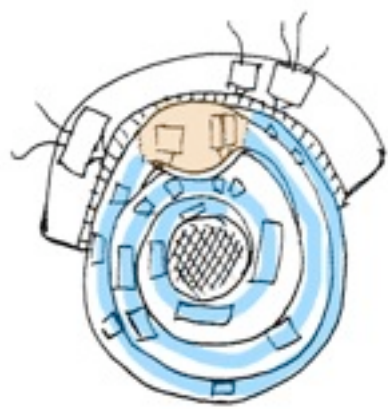
- How can we bring tangibility to interactive surfaces?
- Graphical UI widgets are **only virtual** (i.e., graphical) objects
- Tangible UI are **only physical** objects
  - Sometimes combined with a screen, tabletop (see MetaDesk, DataTiles)
- Take the concept of a **GUI widget**, but **make part of it physical**
  - Tightly coupled physical and virtual parts
  - supports asymmetric two-handed interaction
  - provides visual and haptic stimulus
- Several prototypes currently developed



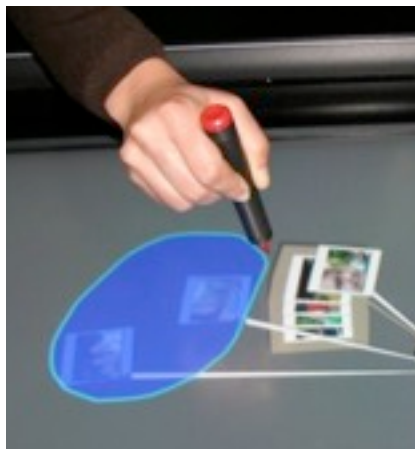


# Example: PhotoHelix



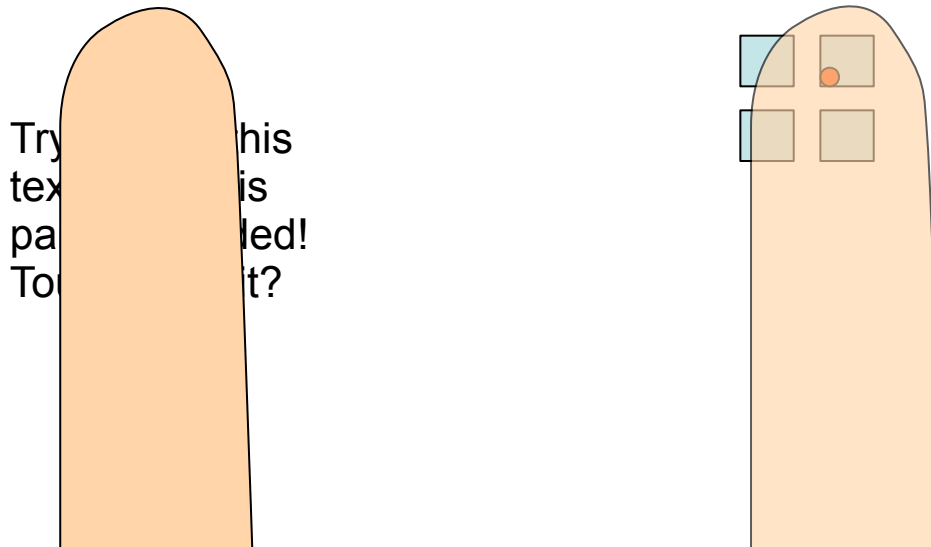


# Example: PhotoHelix



# Occlusions and the Fat Finger Problem

- Fingers and hands can occlude screen objects
  - minimize by choosing a good screen layout!
- fingers may hit several small objects
  - just use large objects ;-)
- exact hit point is occluded



# Example: Shift (Baudisch 2007)

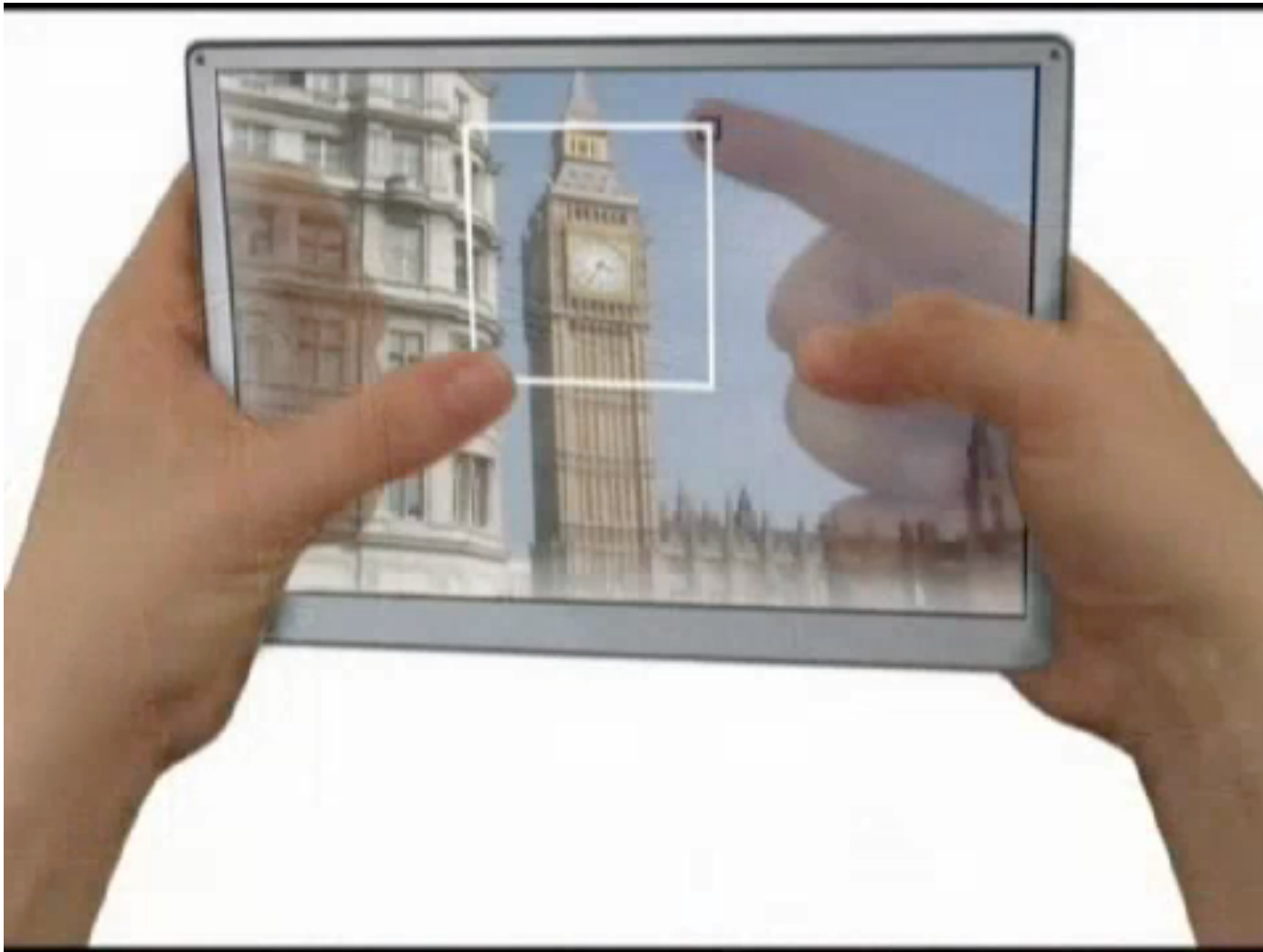
- <http://www.patrickbaudisch.com/projects/shift/>





# Example: Lucidtouch (Baudisch 2007)

- <http://www.patrickbaudisch.com/projects/lucidtouch/>



# Literature

- Guiard, Yves (1987). Asymmetric Division of Labor in Human Skilled Bimanual Action: The Kinematic Chain as a Model. *Journal of Motor Behavior*, 1987, 19, 486-517
- Scott, S.D., Carpendale, M.S.T, & Inkpen, K.M. (2004). Territoriality in Collaborative Tabletop Workspaces. In *Proceedings of the ACM Conference on Computer-Supported Cooperative Work (CSCW)'04*, November 6-10, 2004, Chicago, IL, USA.
- Russell Kruger, Sheelagh Carpendale, Stacey D. Scott, Saul Greenberg. How People Use Orientation on Tables: Comprehension, Coordination and Communication. In: *ACM GROUP 2003*
- Vogel, D. and Baudisch, P. Shift: A Technique for Operating Pen-Based Interfaces Using Touch. In *Proceedings of CHI 2007*
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