Tangible Lenses, Touch & Tilt: 3D Interaction with Multiple Displays

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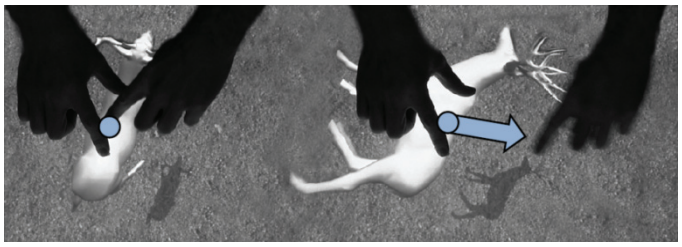
UI & SE

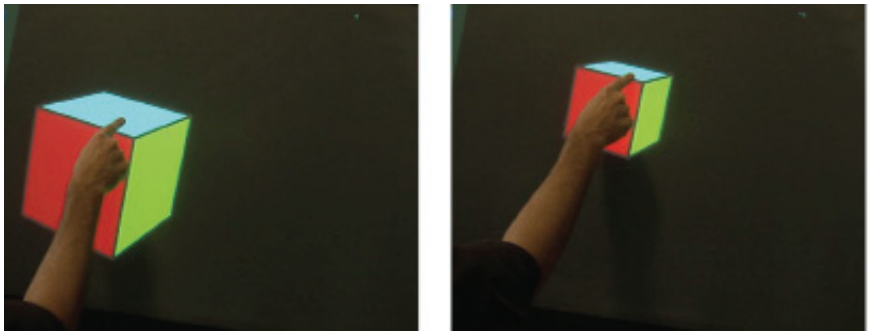
Motivation

Interacting with 3D content **ON** multitouch devices

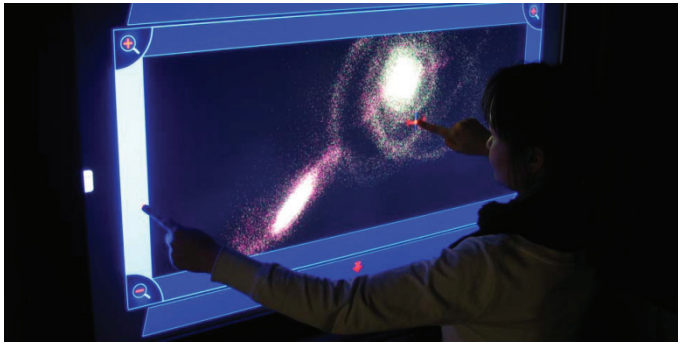
- Size limited, large surfaces rarely supported
- Reachability limited for large displays
- Rarely support of multiple users

[Hancock et al. ITS 2009]





[Reisman et al. UIST 2009]



[Yu et al. TVCG 2010]

Our Vision

Handheld Displays or Tangible Lenses

+

Large Displays
(Walls & Tabletops)

for effective

Remote 3D Interaction

3D Interaction with Handheld Displays

1. Spatial device interaction (WITH-device interaction)

Tilting and moving the displays through space

With and without relation to the (remote) display

2. Surface interaction (ON-device interaction)

Multitouch input

Pen input

3. Both combined

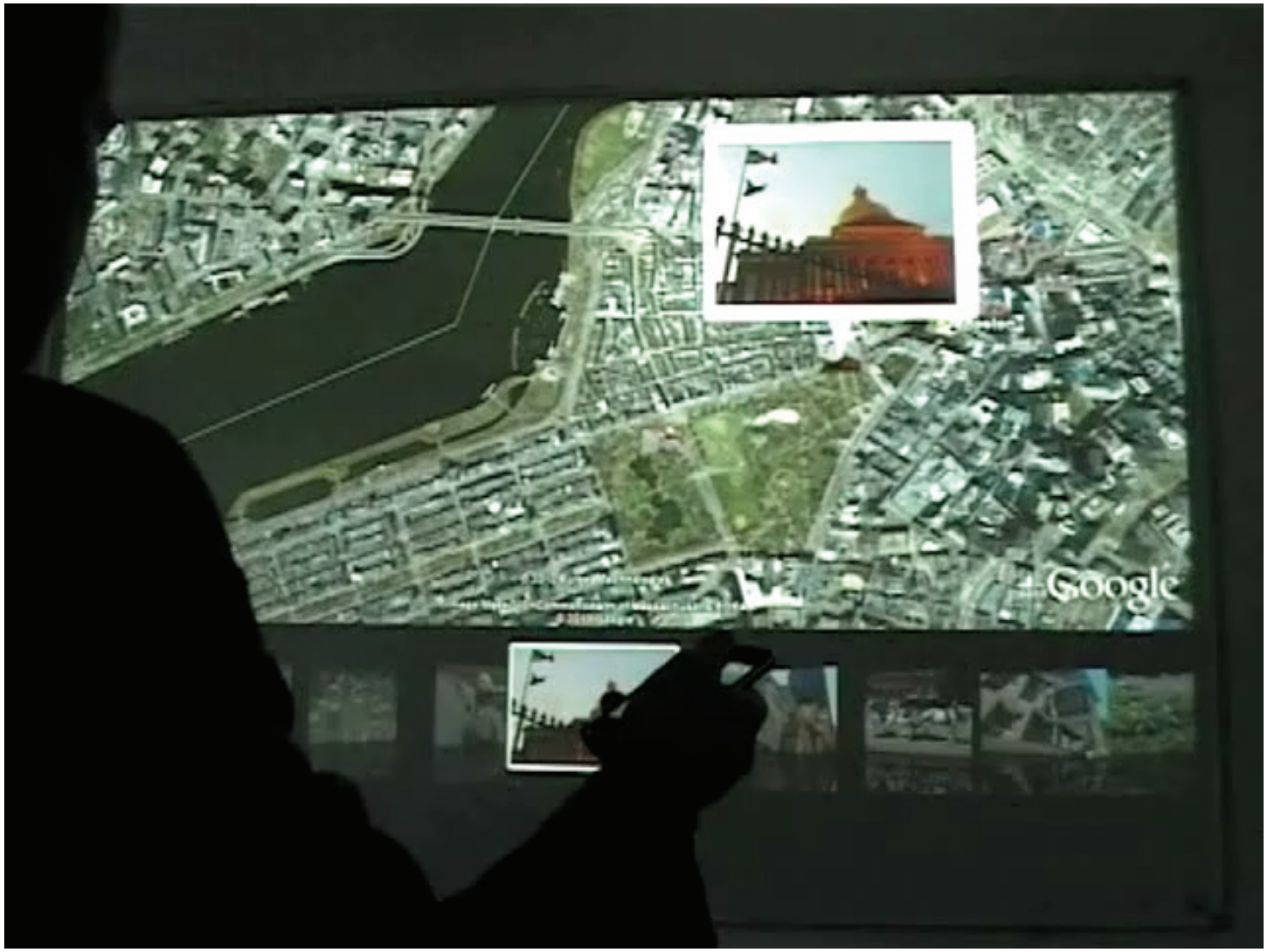
See also earlier work, e.g. [Mine et al. 1997]

Handheld as Eyes-free Controller: Touch & Tilt Interaction

Throw & Tilt [Dachselt & Buchholz MEIS 2008]

Throw & **Tilt & Touch** [Dachselt & Buchholz CHI 2009]

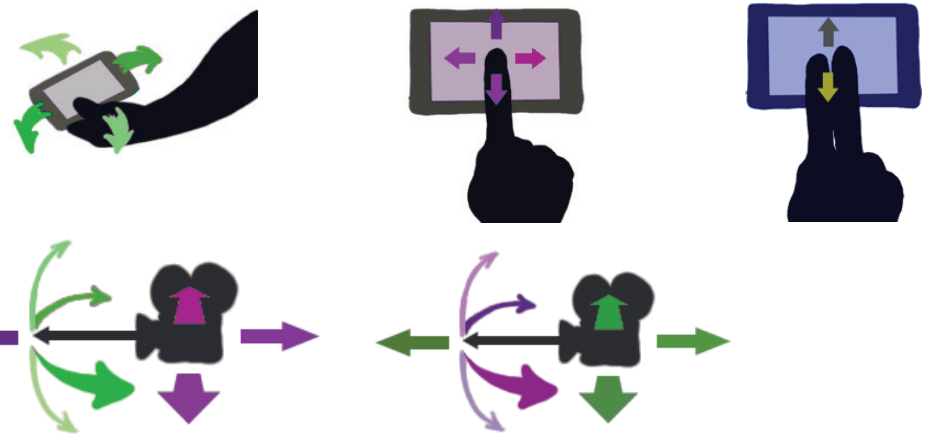
Throw & Tilt & Touch [Dachselt & Buchholz CHI 2009]



Further Investigations (eyes free operation)

Concerning the mapping of

- Tilt &
- Touch events

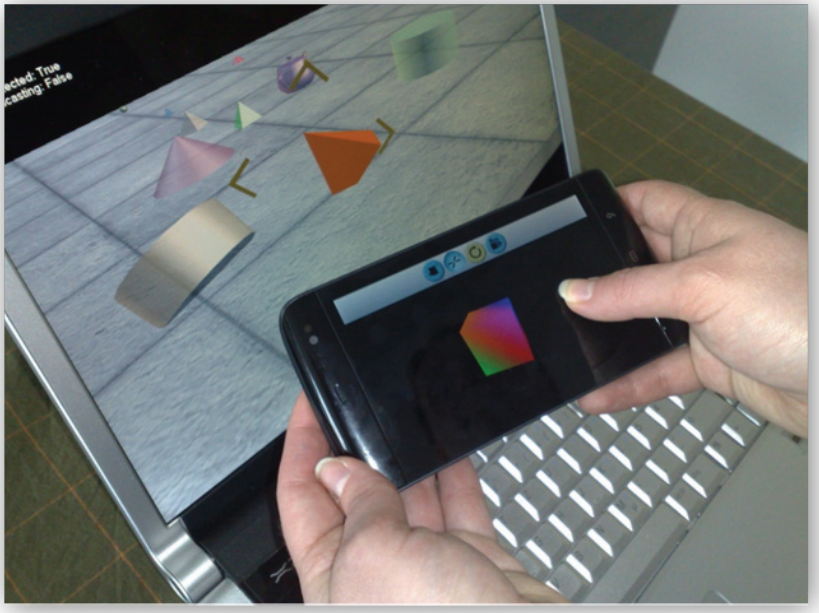


to camera

- Orientation
- Position

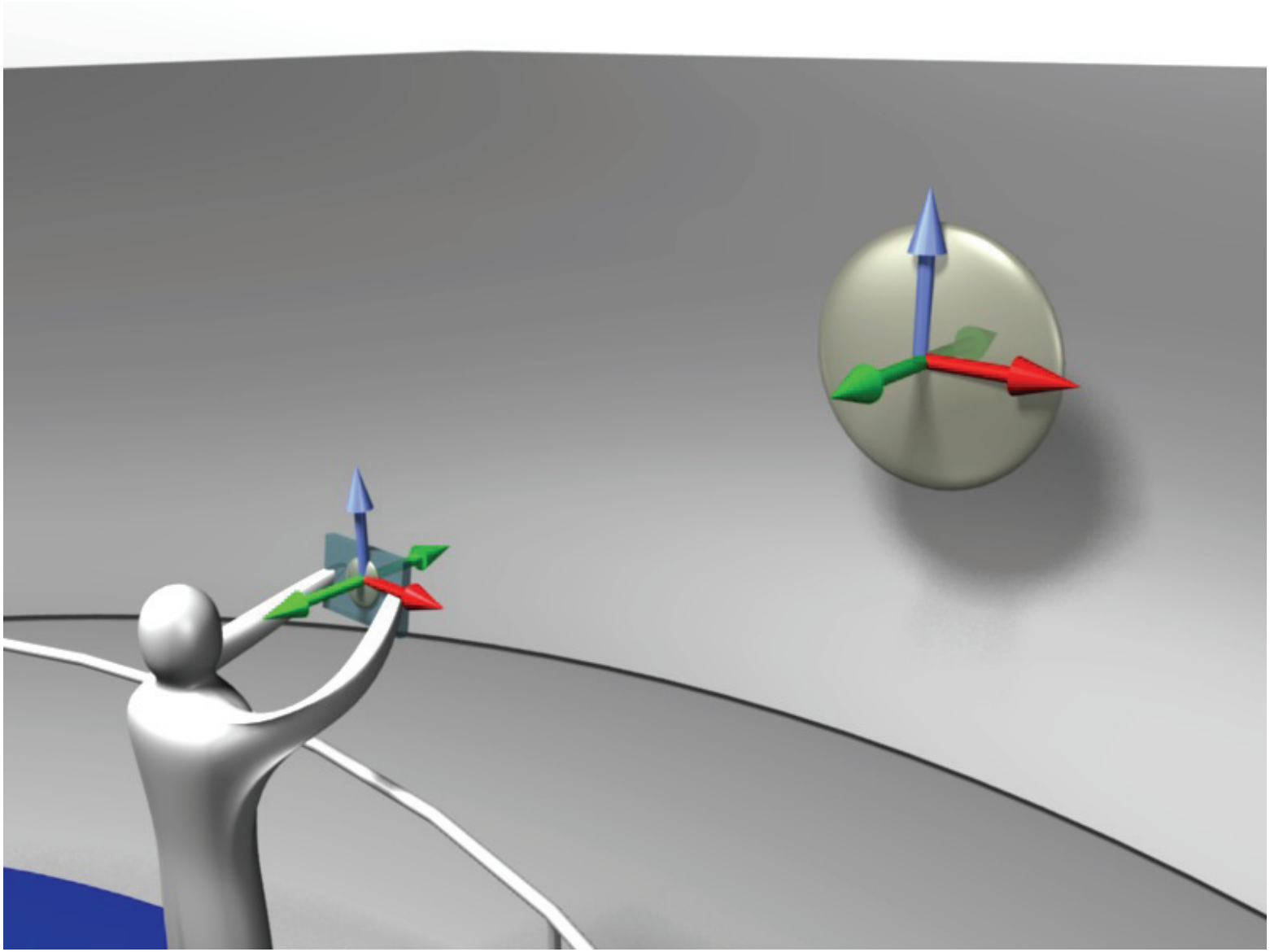
to object

- Rotation
- Translation
- Scaling



Handheld as Movable Display

Coordinate Systems

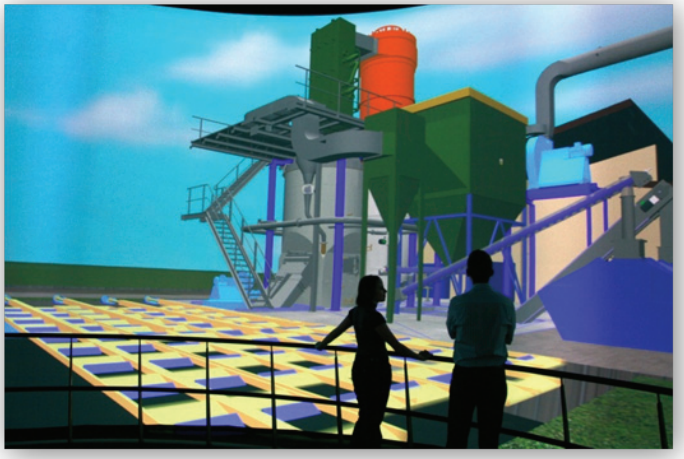


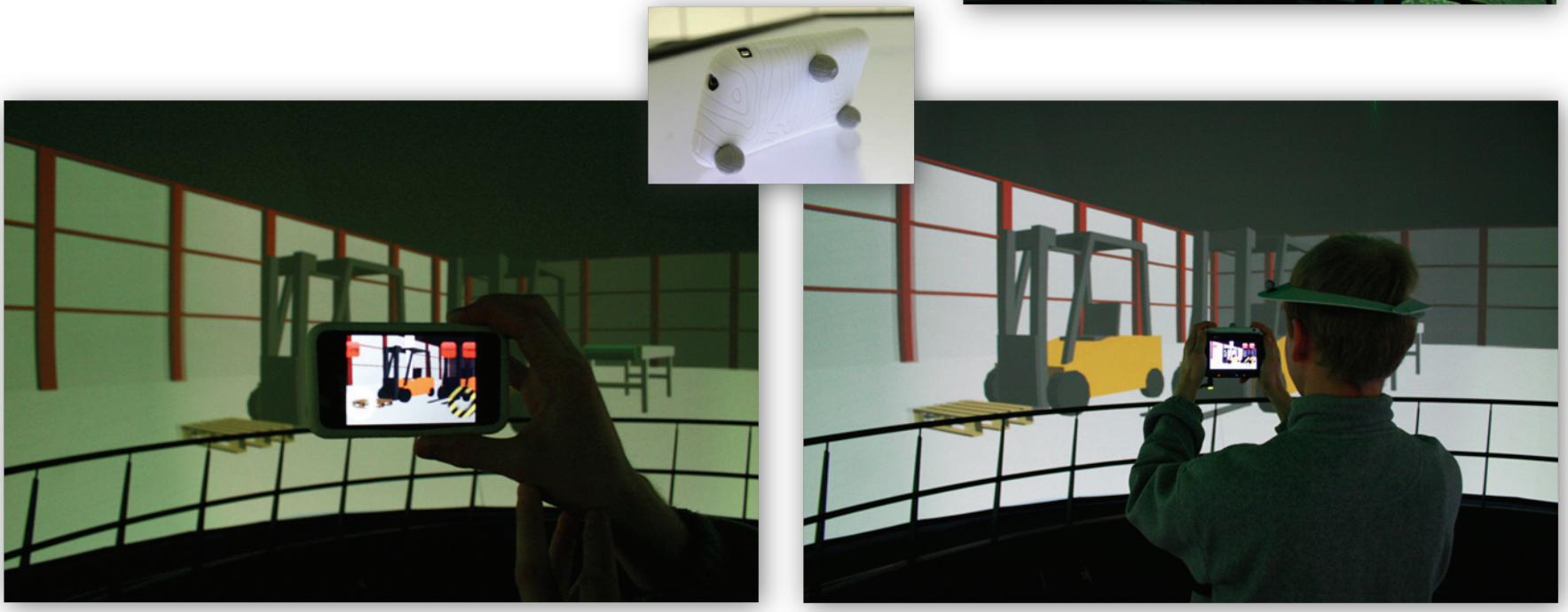
Current Work: Multi-Display-Environments

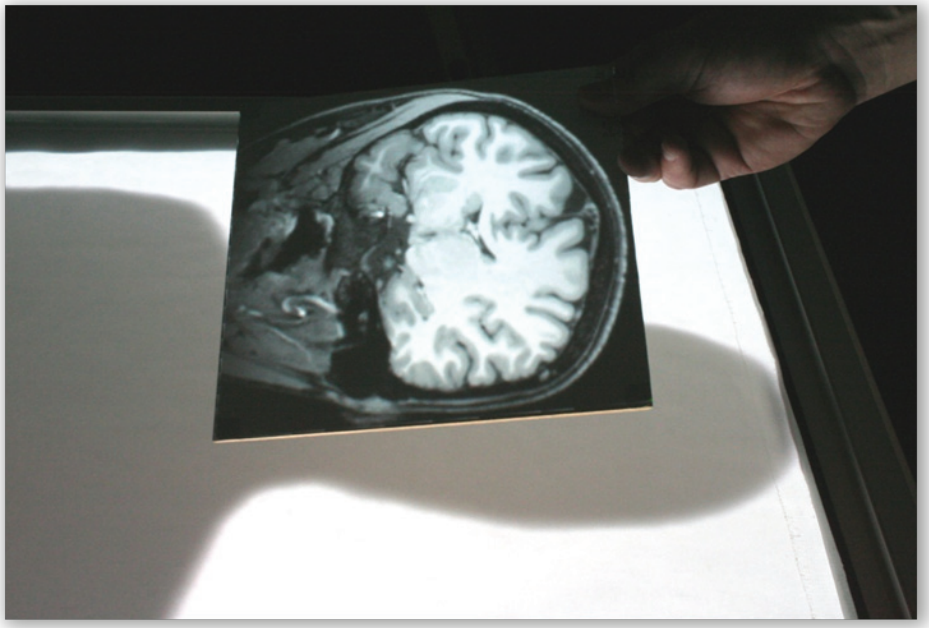
Fraunhofer VDTC Magdeburg, Elbe-Dom

Magic Lenses in Large Multi-Display VR Environments

- Ultra large VR displays (360°)
- Tracking handheld devices
  - to move 3D objects around
  - [Henneberg, Theses 2010]

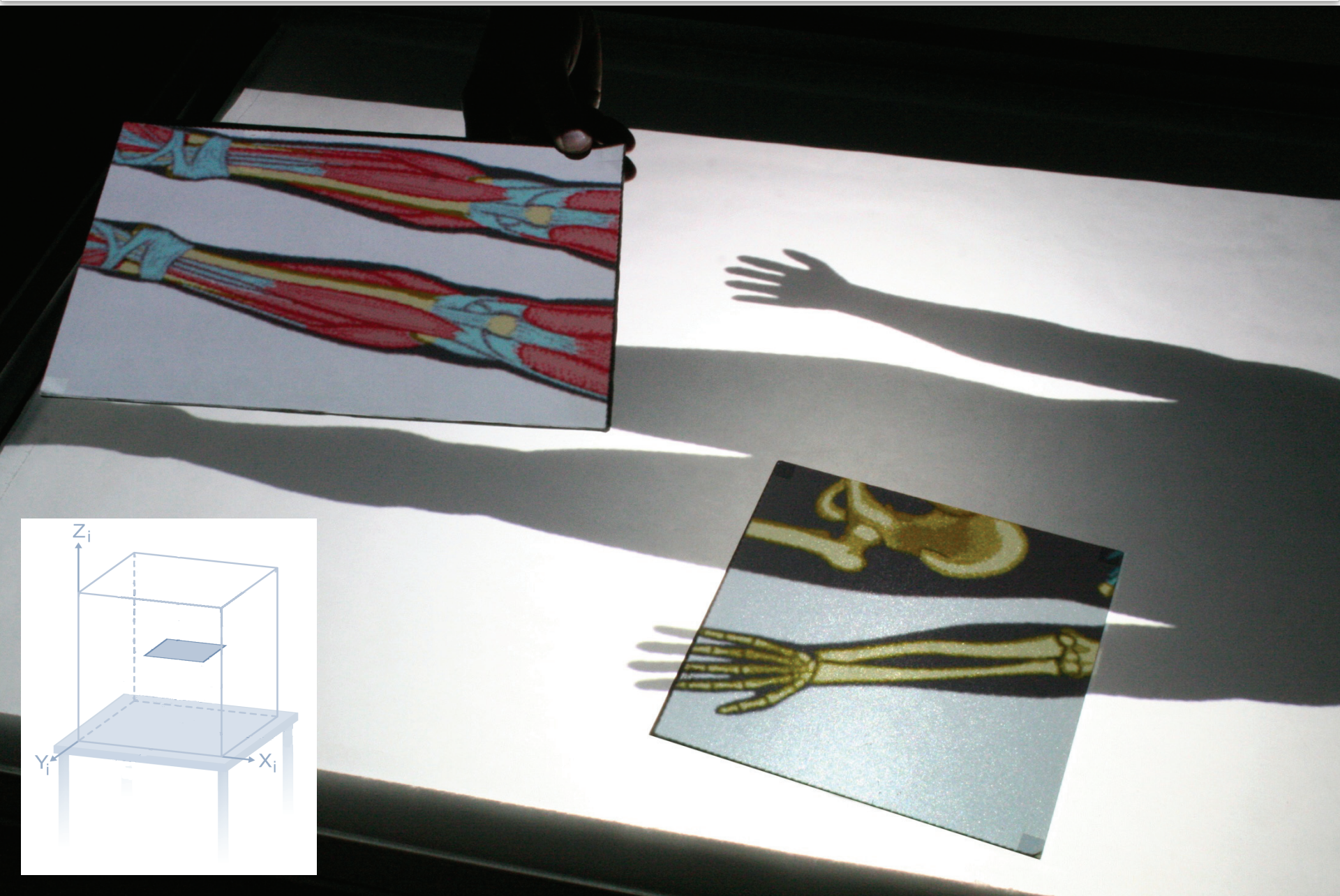




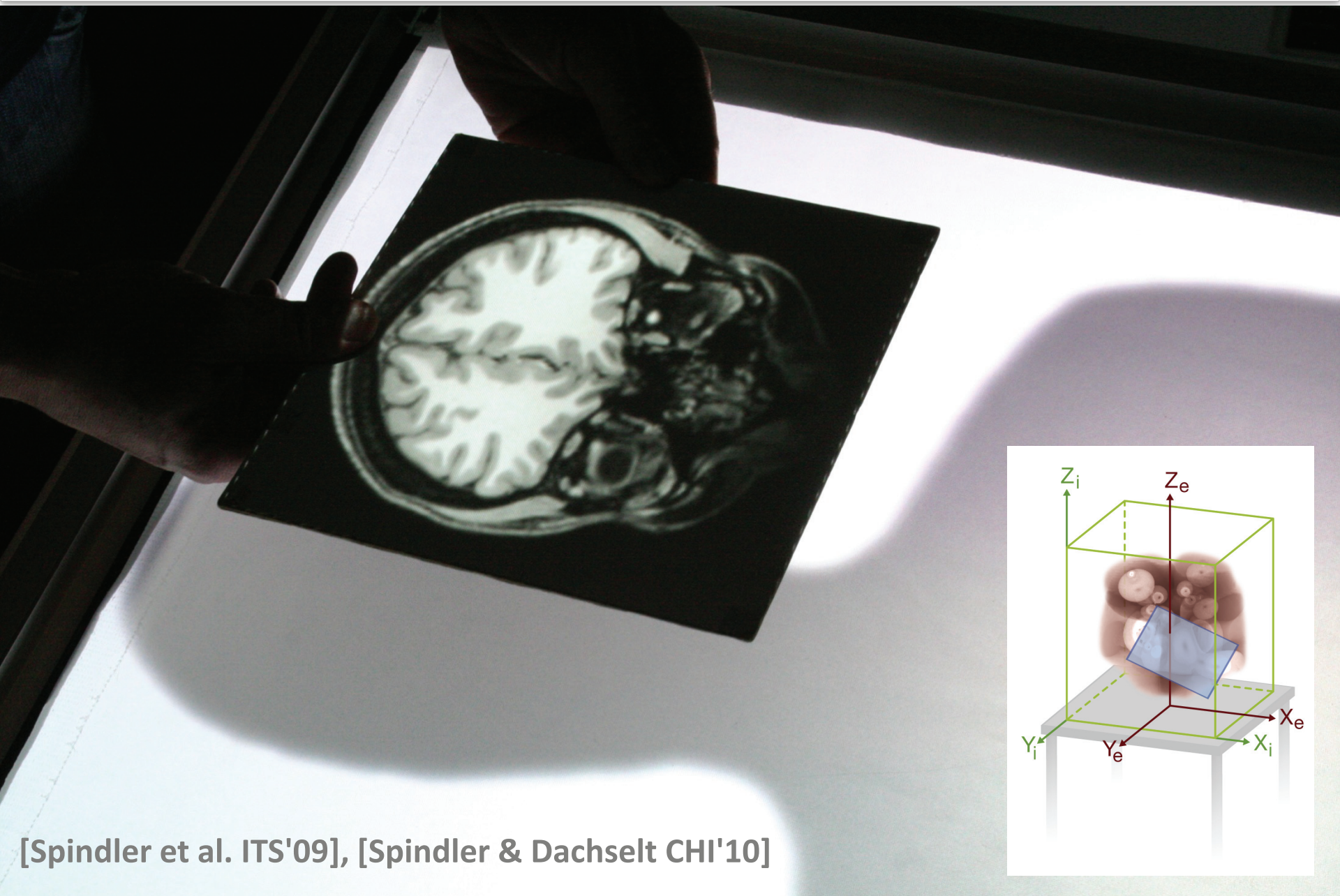


Handheld as Movable Display: Tangible Magic Lenses

Tangible Magic Lenses – Location-aware Displays

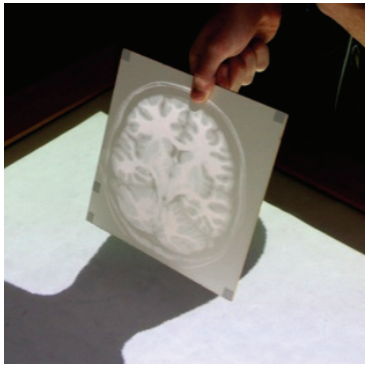


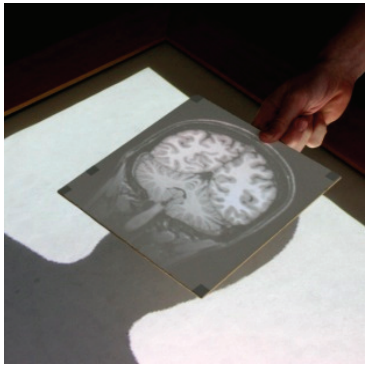
Volumetric Information Space

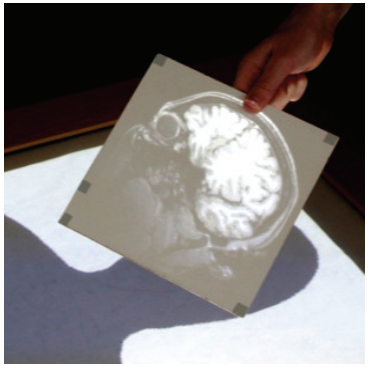


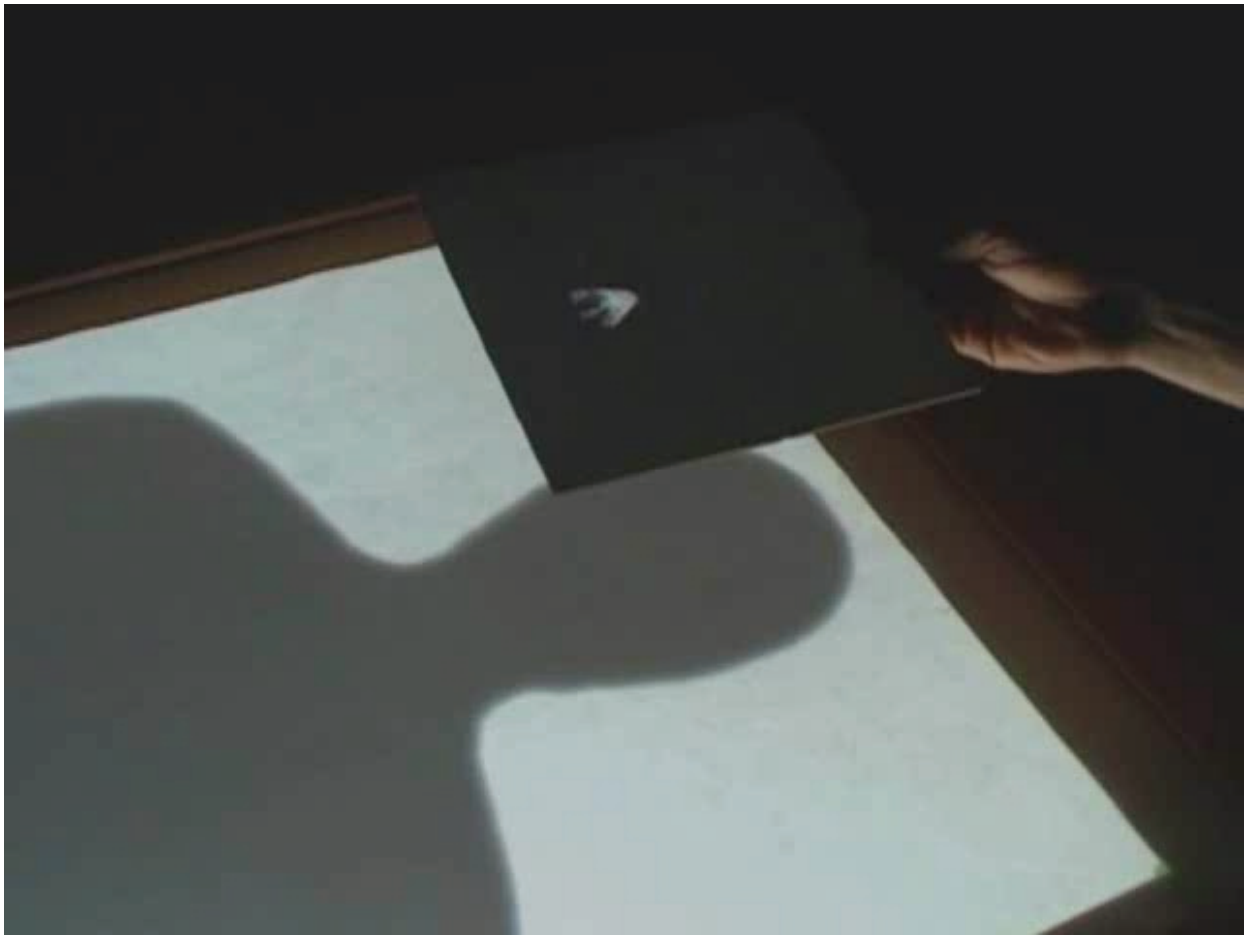
[Spindler et al. ITS'09], [Spindler & Dachselt CHI'10]

Volumetric Information Space



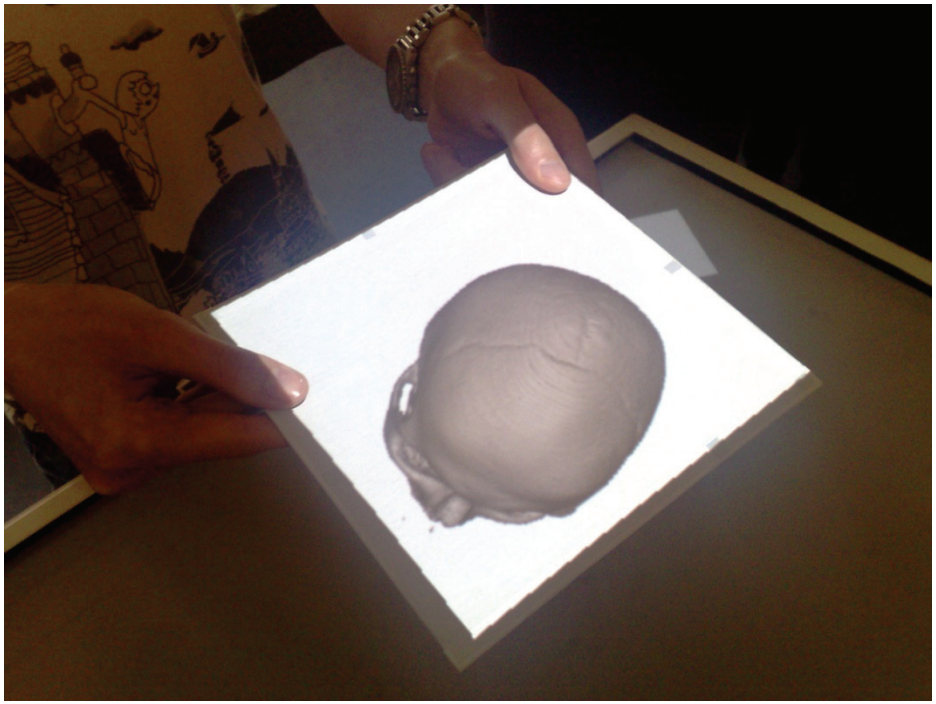


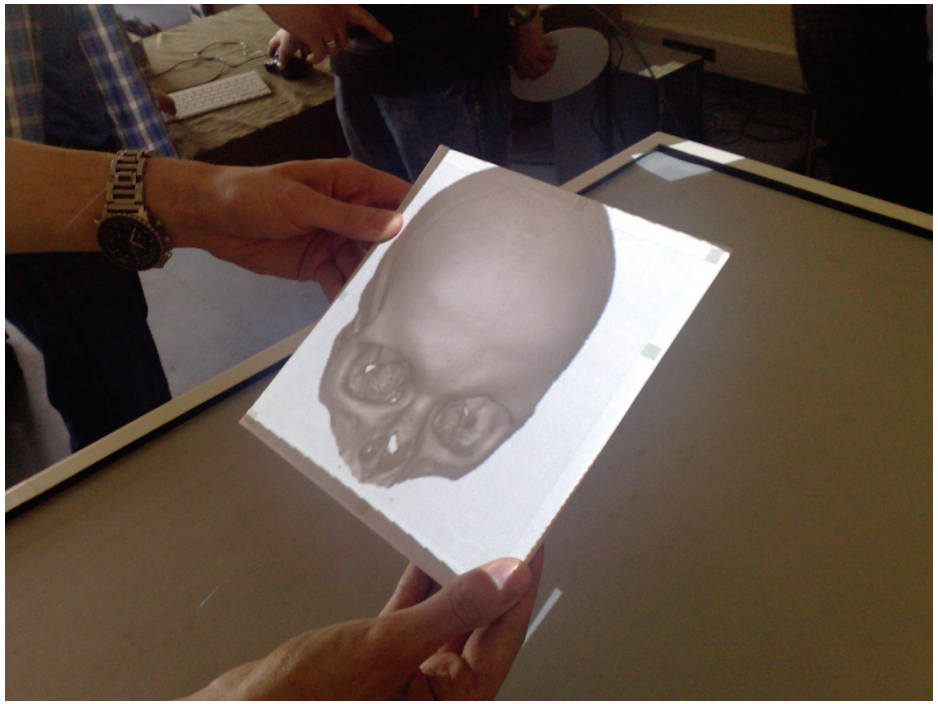




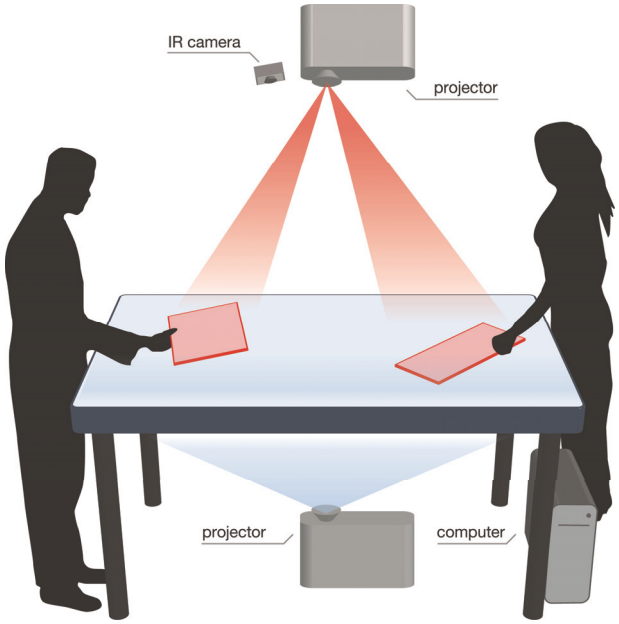
[Spindler et al. ITS'09], [Spindler & Dachselt CHI'10]

Volumetric Information Space

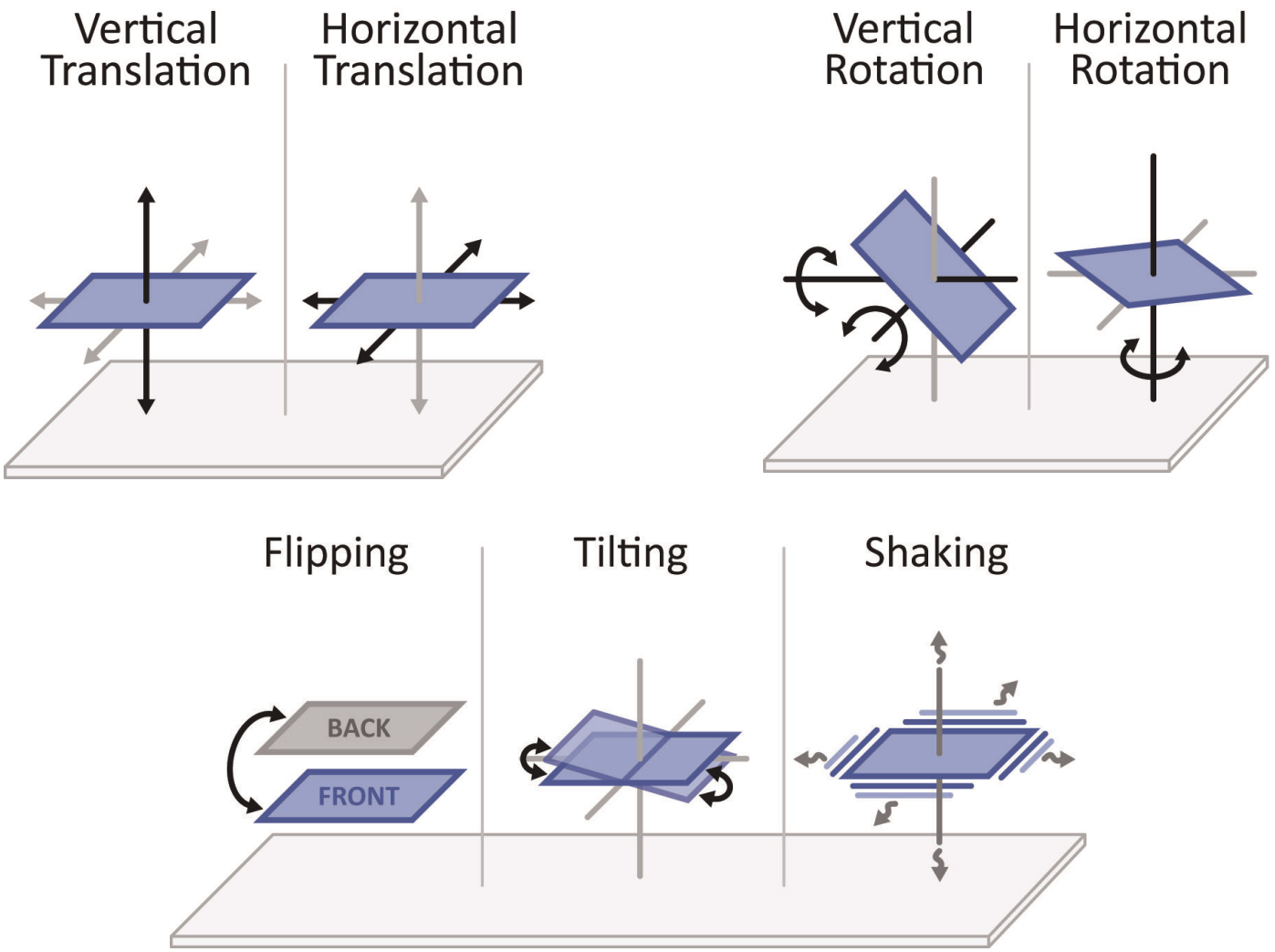




Technical Approach

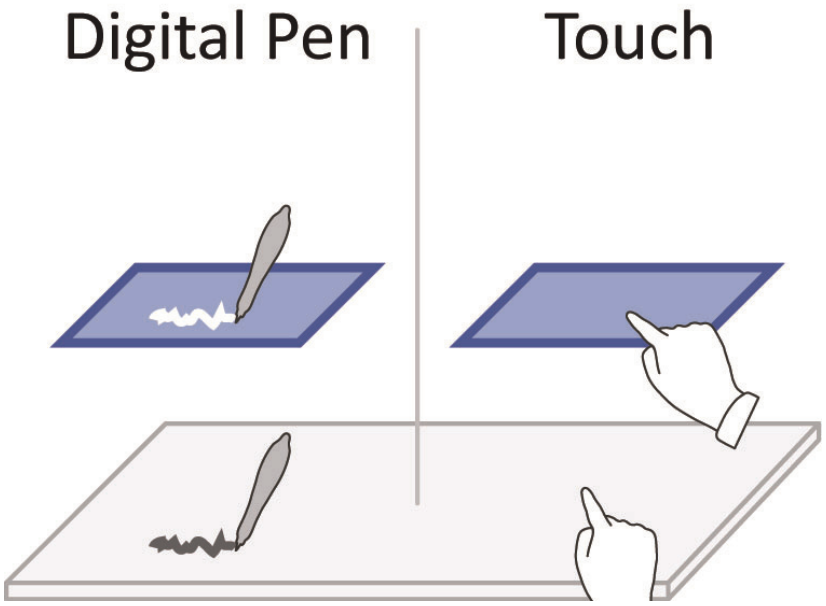


Moving and tilting the lens – WITH-the-lens interaction



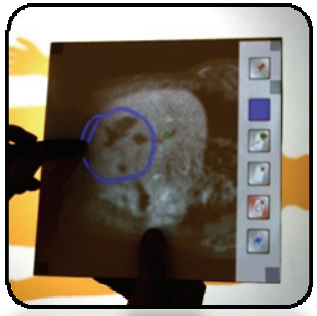
[Spindler et al. ITS'10]

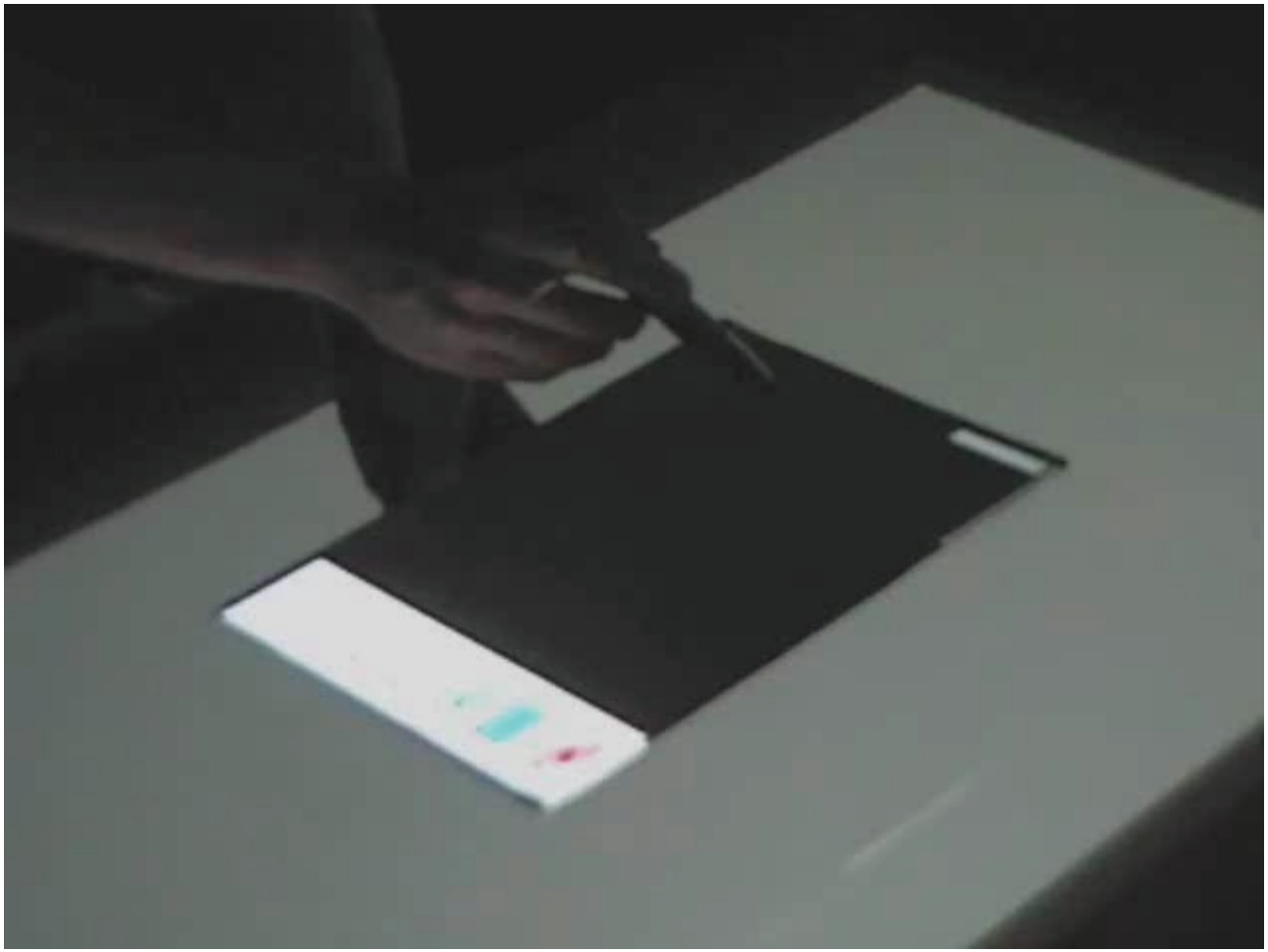
ON-the-lens interaction



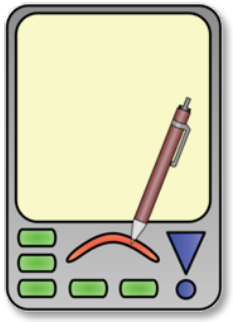
[Spindler et al. ITS'10]

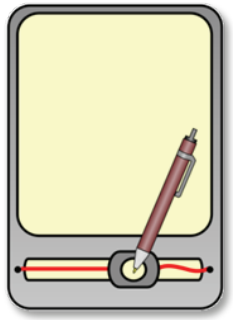
Direct Pointing – Drawing with a Pen





Pen used for Navigation and Application Control

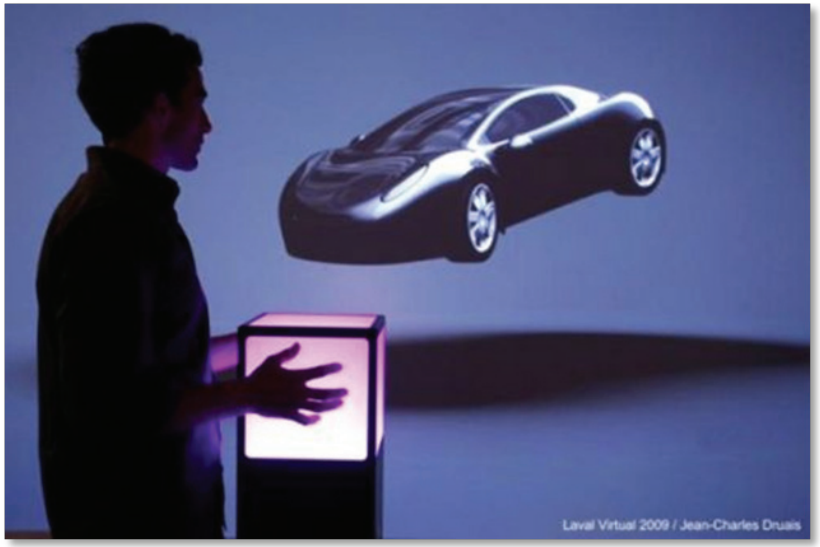


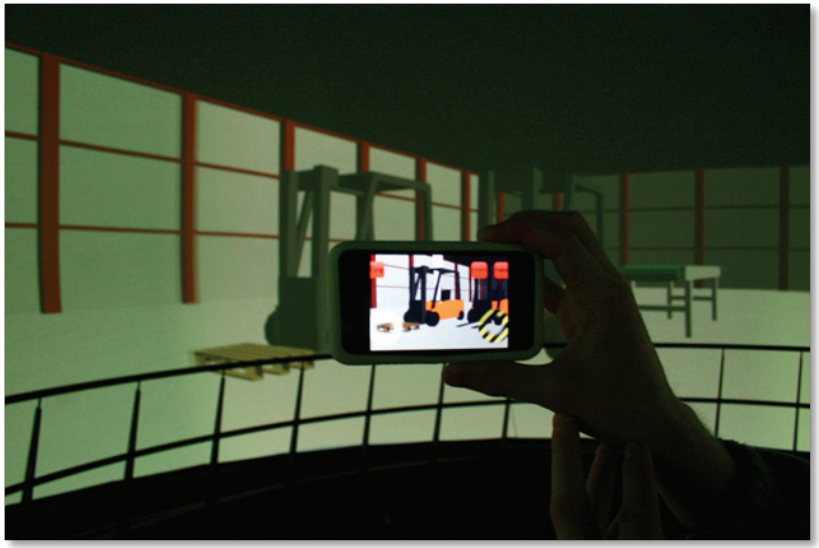


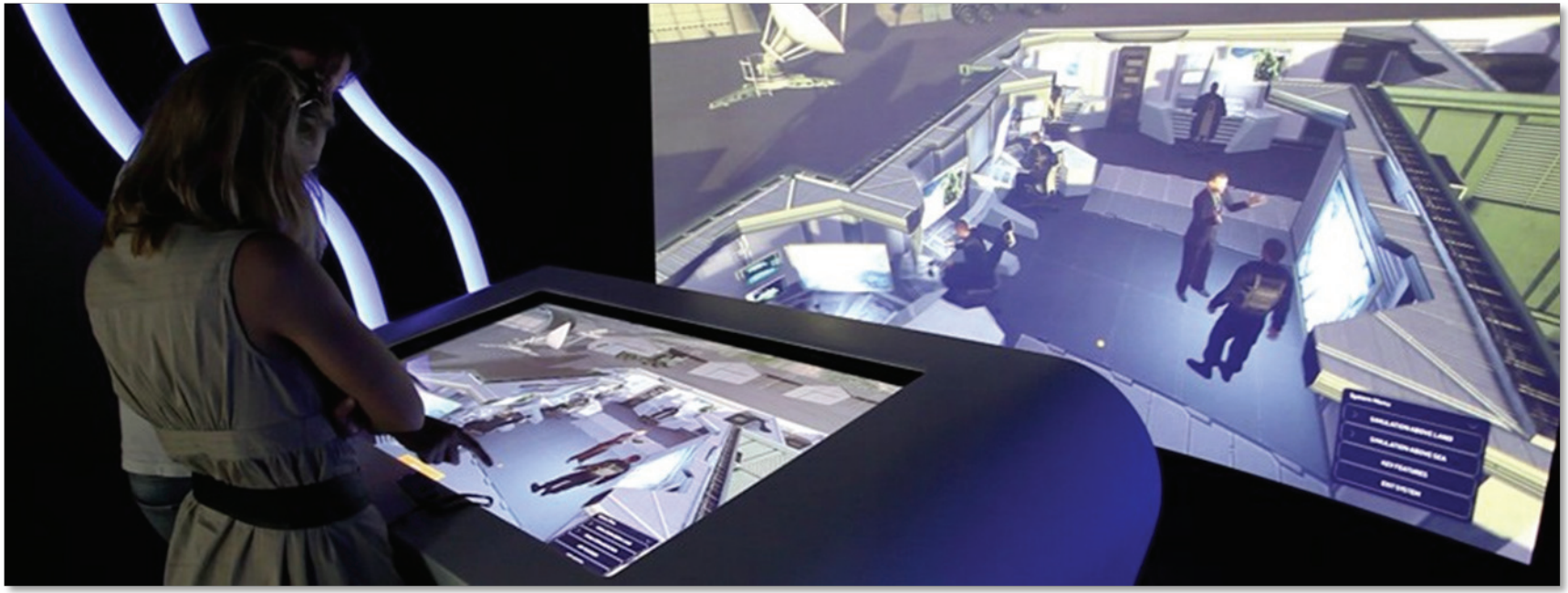
[Stellmach et al. M&C 2010]

Conclusion

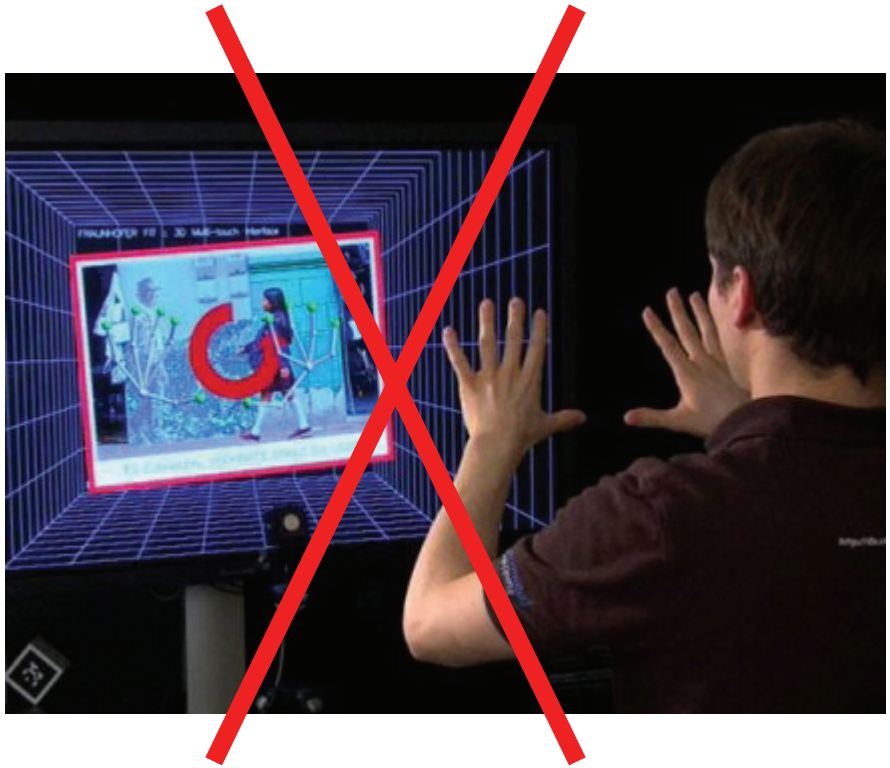
Remote 3D interaction important issue

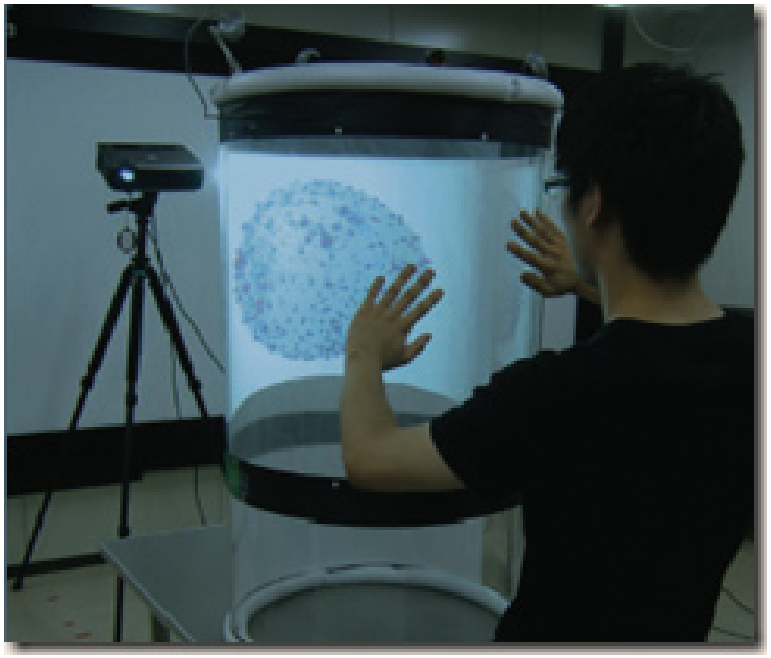






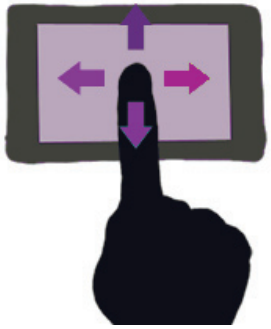
Good affordances and haptic feedback crucial

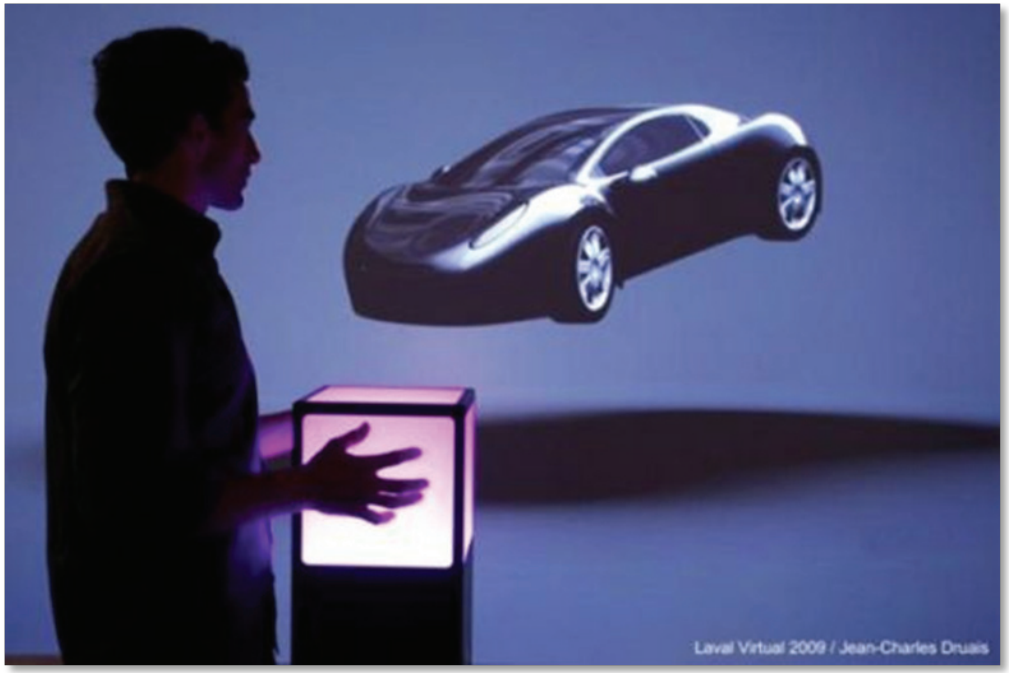




Compare [Nancel et al. CHI 2011]

Support constraints and separately controllable DOF



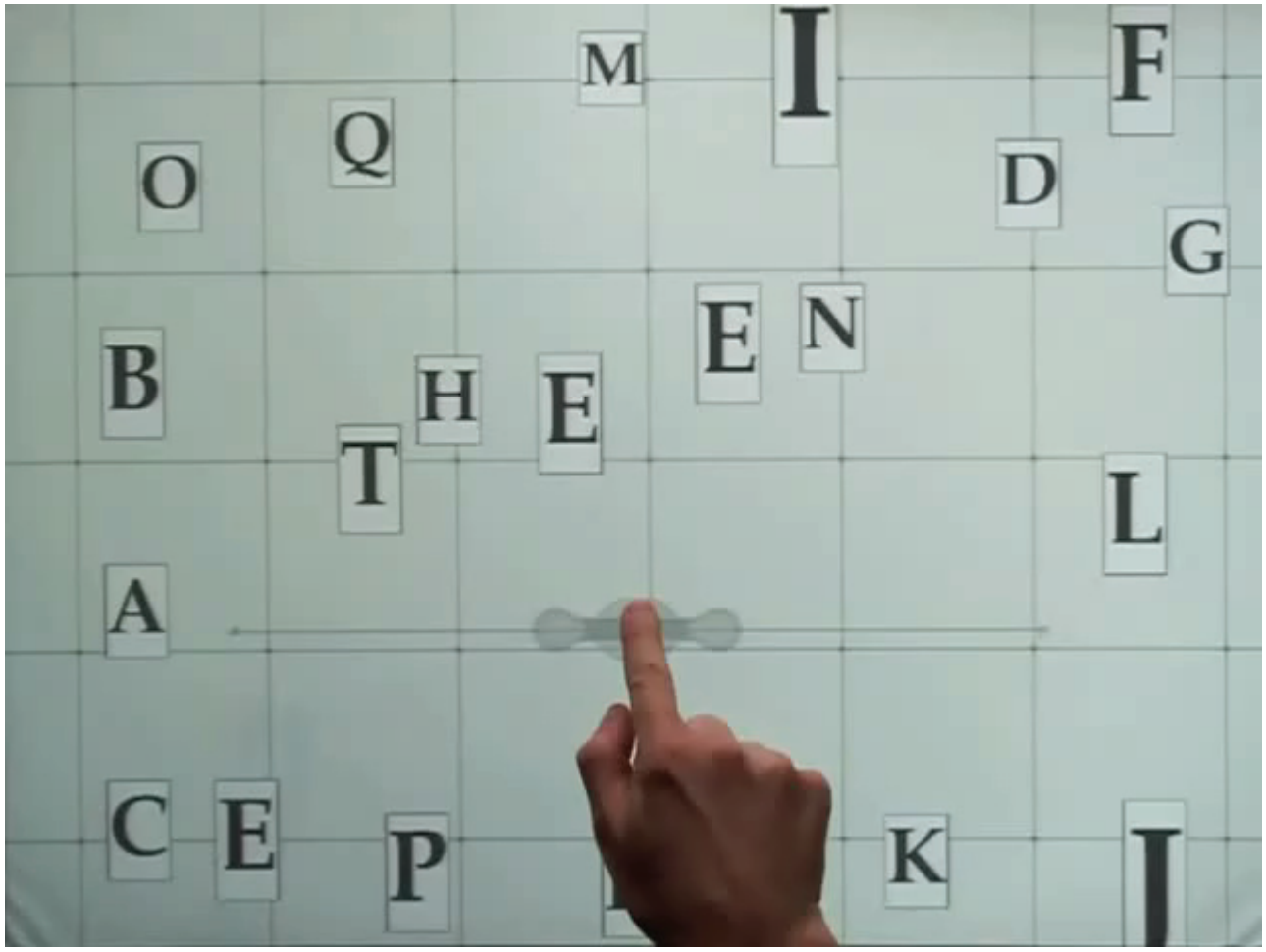


More Challenges

- Appropriate mappings (e.g. tilting vs. touching)
- Combining modalities (Touch + Tilt + Pen + ….)
- Find consistent gesture sets
- Combination of multiple lenses (already done)
- Collaboration, coordinated control
- Stereoscopic displays (or pseudo-stereoscopic)

Also consider VR work from the 90ies [Bowman et al. 2004]

Sneak Preview "Grids & Guides" (Tuesday 4 pm Multitouch)



References

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