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Mutual Occlusions on Table-top Displays in Mixed Reality Applications

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Introduction

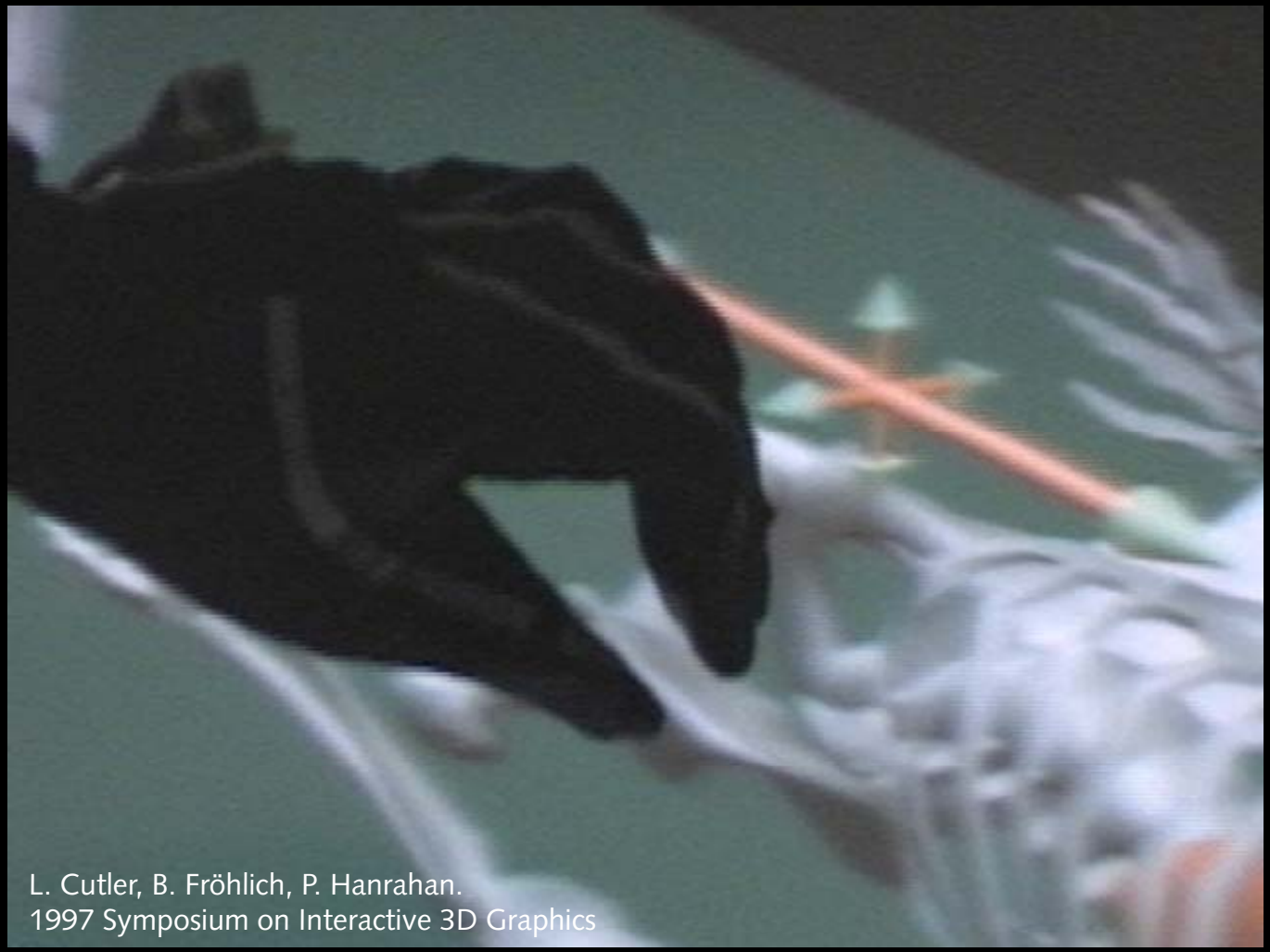



Microsoft Surface
(courtesy of Microsoft Corporation)

Introduction (cont'd)

L. Cutler, B. Fröhlich, P. Hanrahan.
1997 Symposium on Interactive 3D Graphics

Introduction (cont'd)



L. Cutler, B. Fröhlich, P. Hanrahan.
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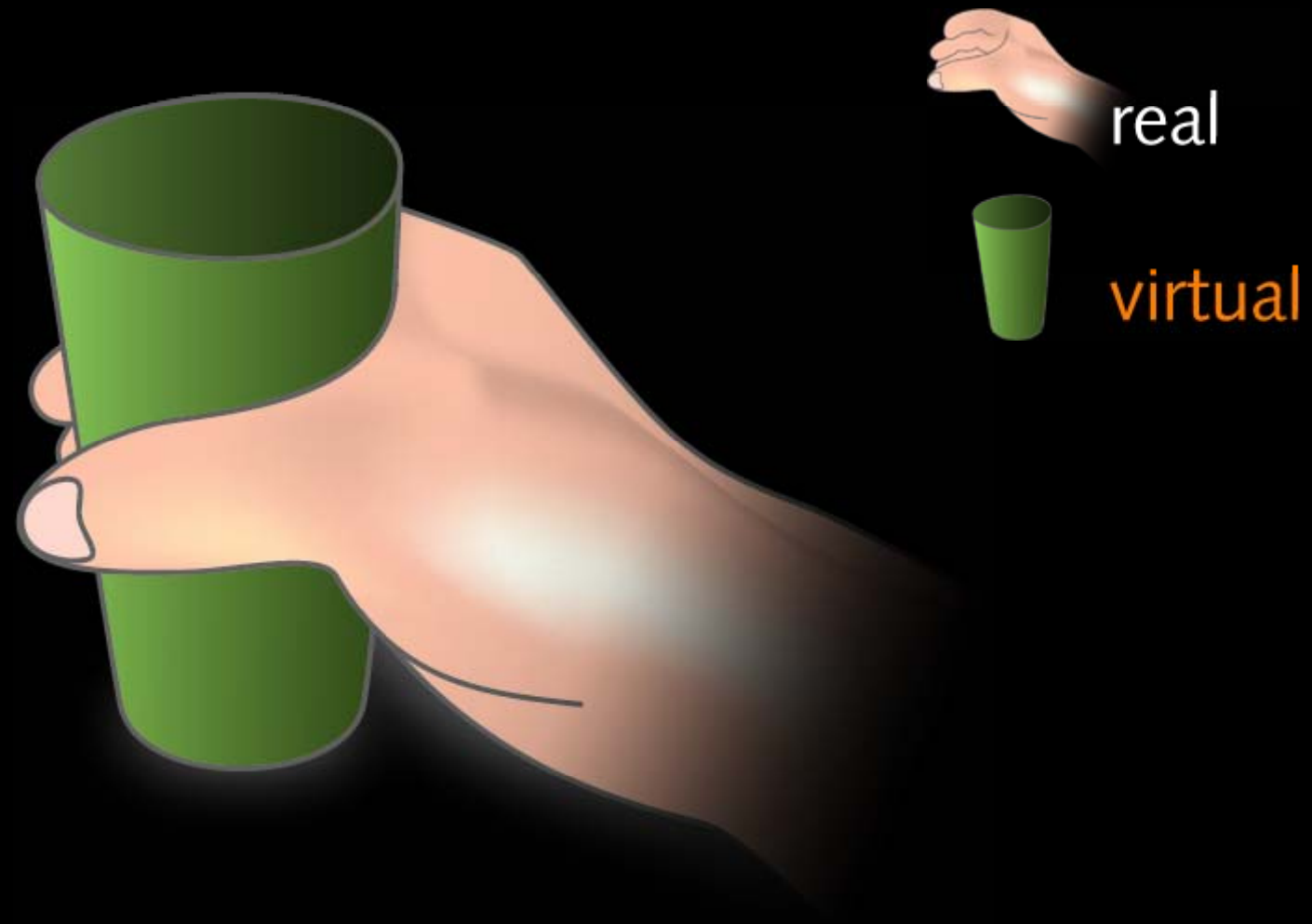
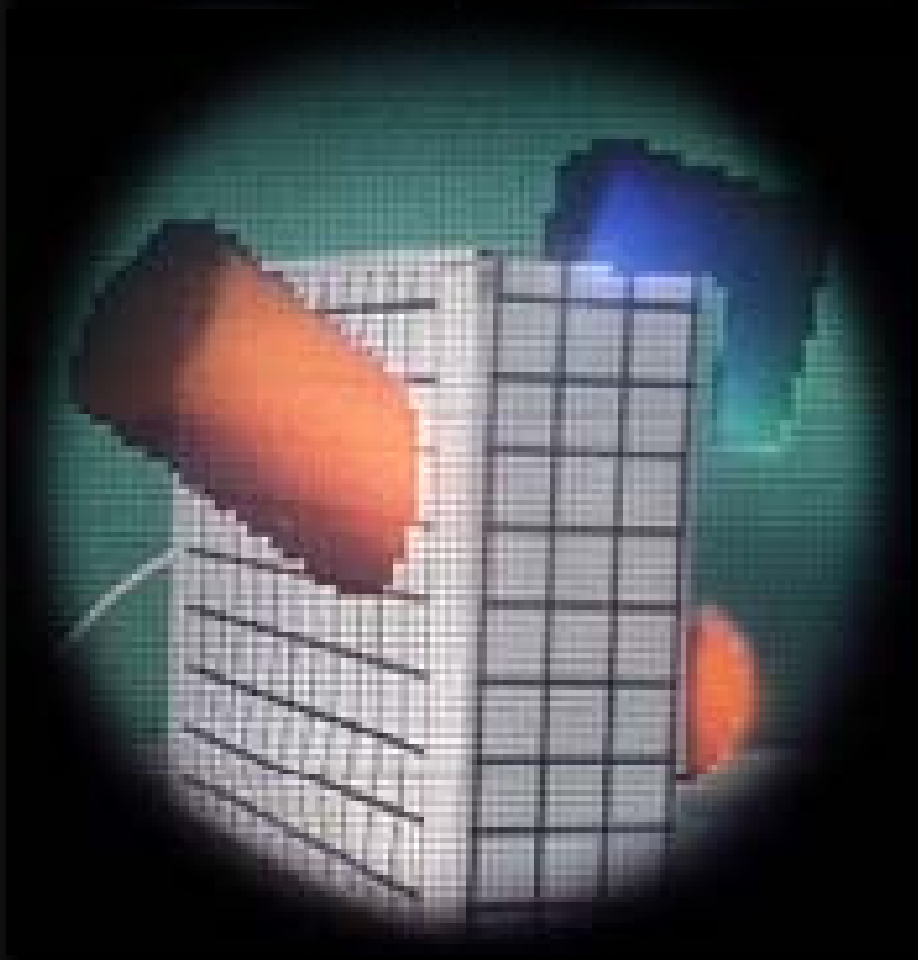
Motivation

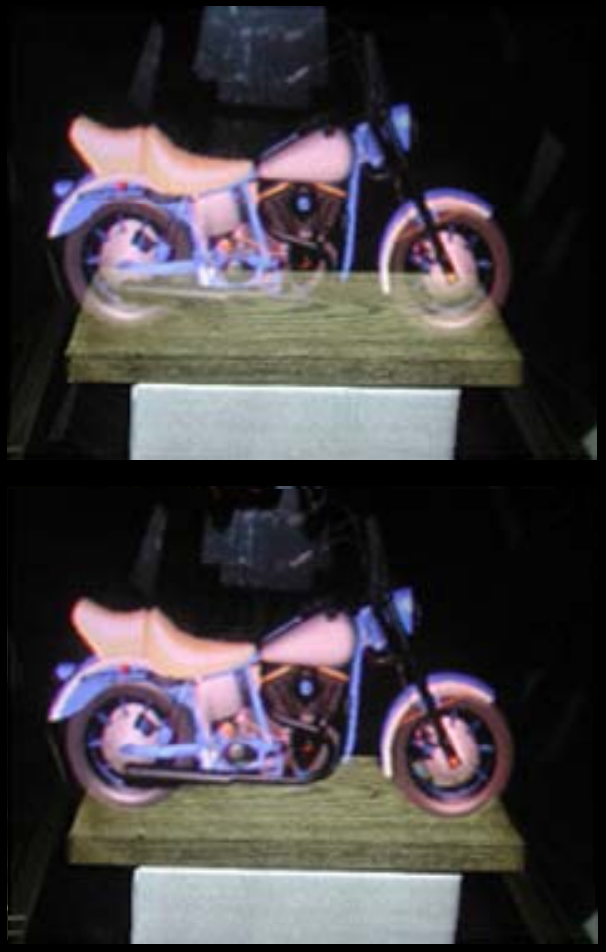


Related work



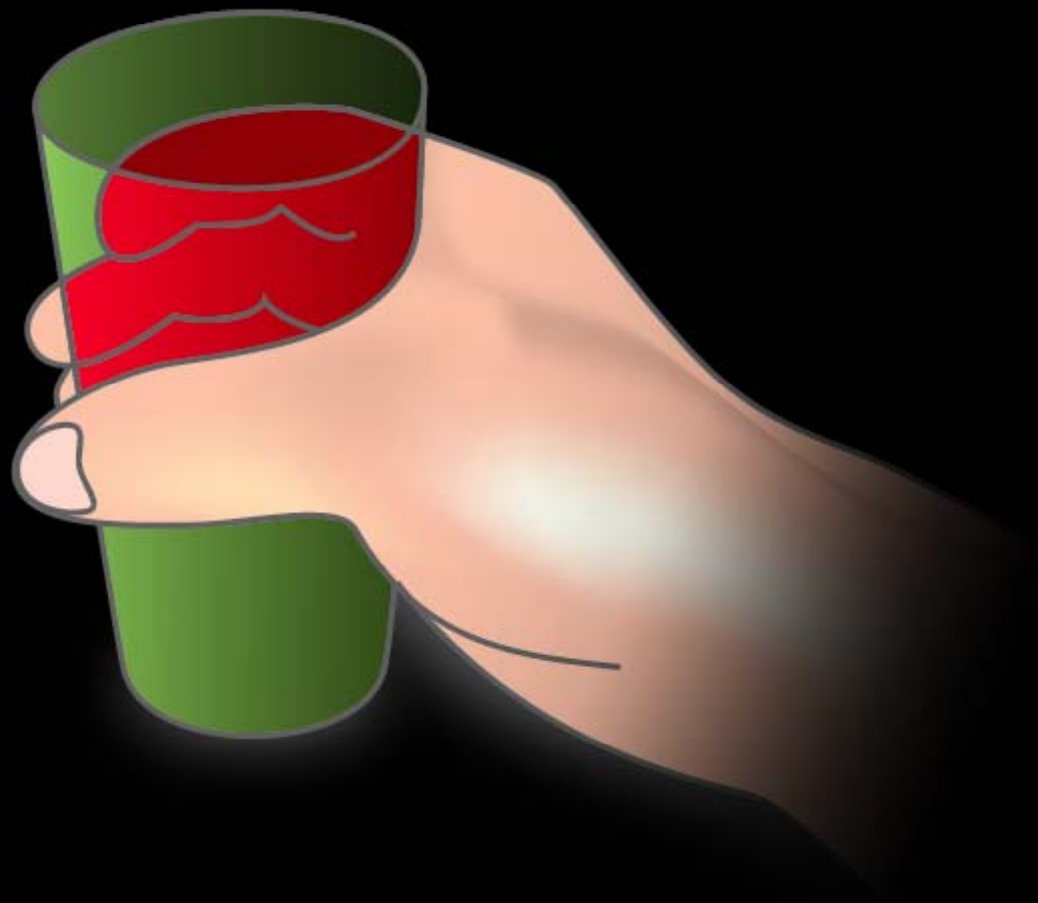
- Mutual occlusions for head-mounted displays
  - Kiyokawa et al., ISMAR 2003
- ELMO
  - Enhanced see-through display using an
  - LCD panel for
  - Mutual
  - Occlusion

Related work (cont'd)

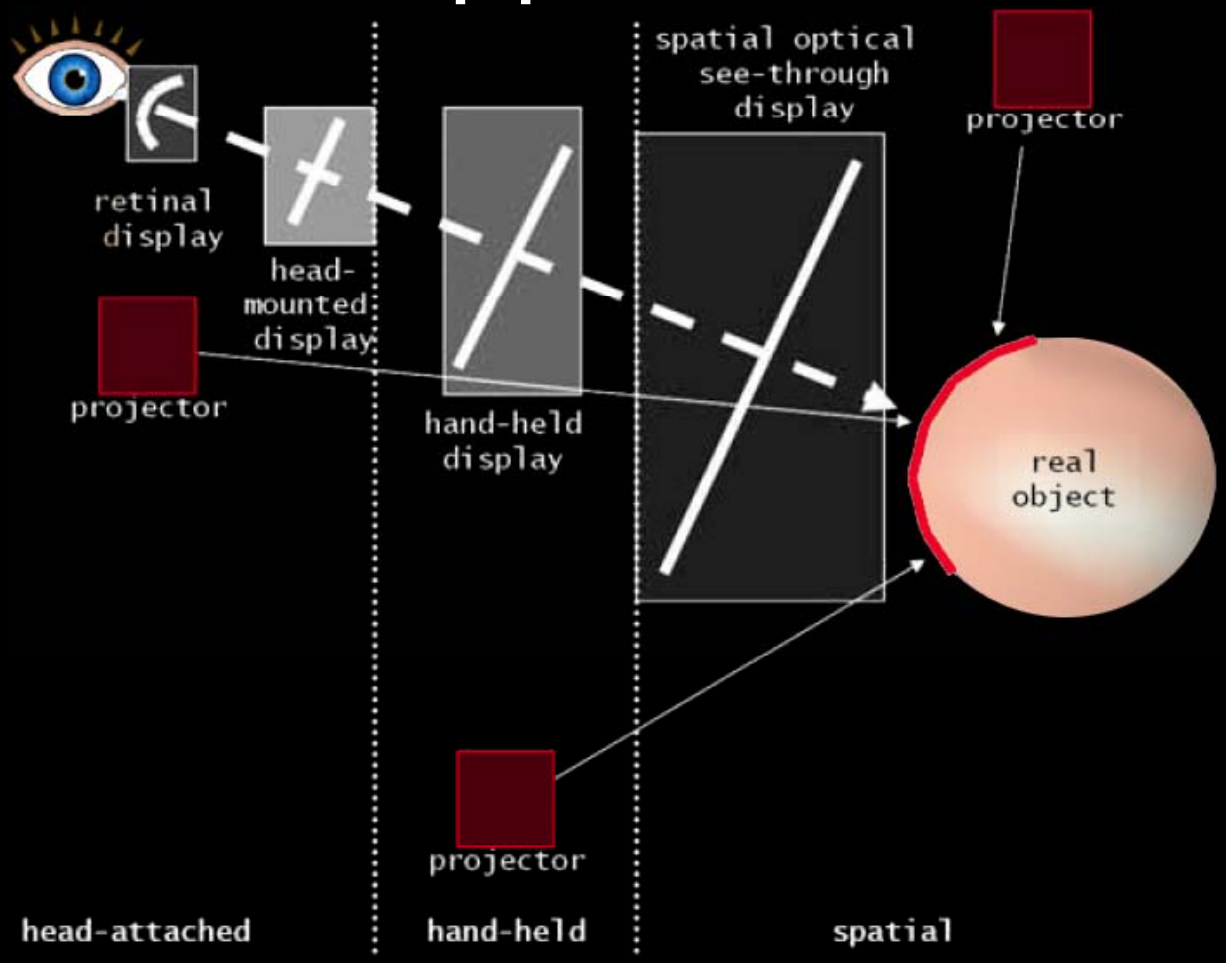


- Mutual occlusions for the Virtual Showcase
  - Bimber and Fröhlich, ISMAR 2002
  - Spatial optical see-through display
- Occlusion Shadows
  - Projector-based illumination
  - Illuminating those parts that are not occluded by virtual content only

Motivation

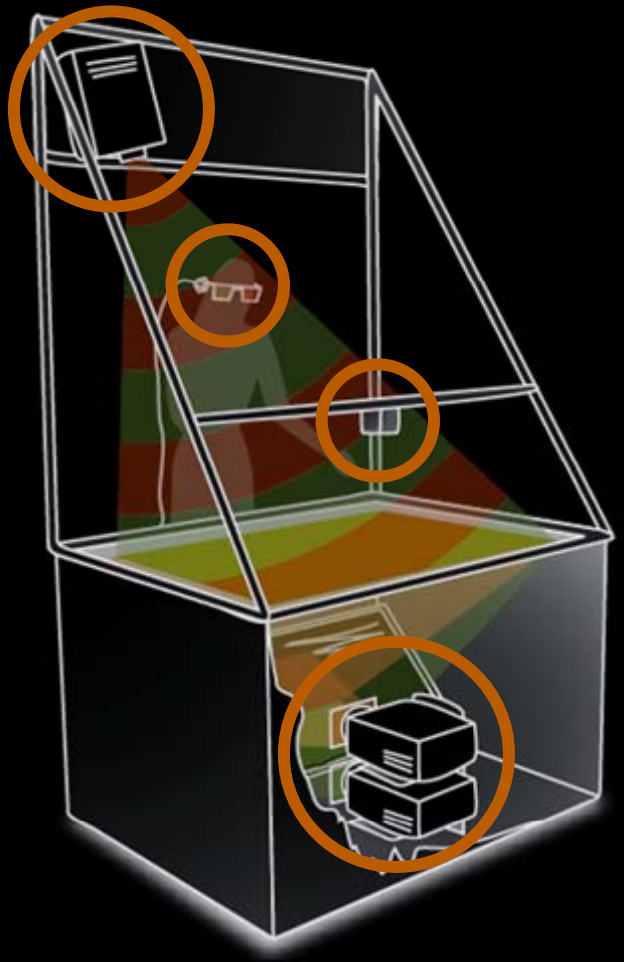


Approach



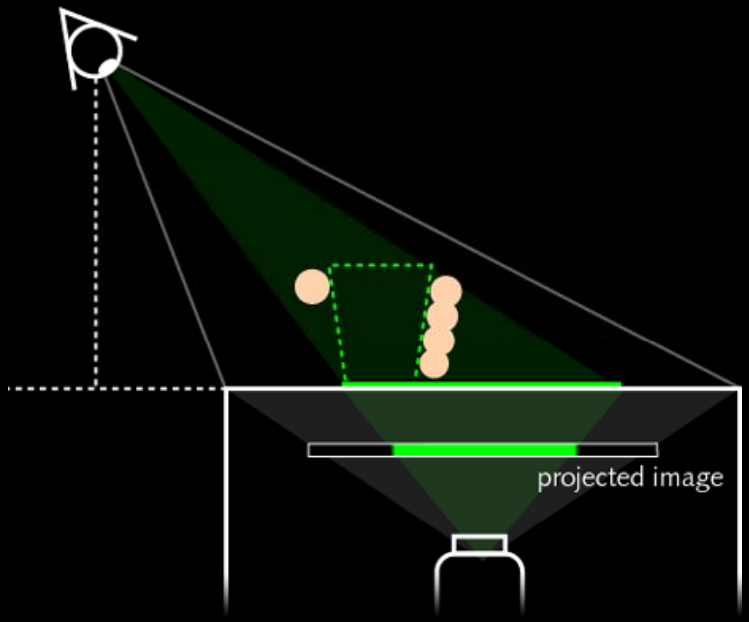
Bimber and Raskar, Spatial Augmented Reality

Setup



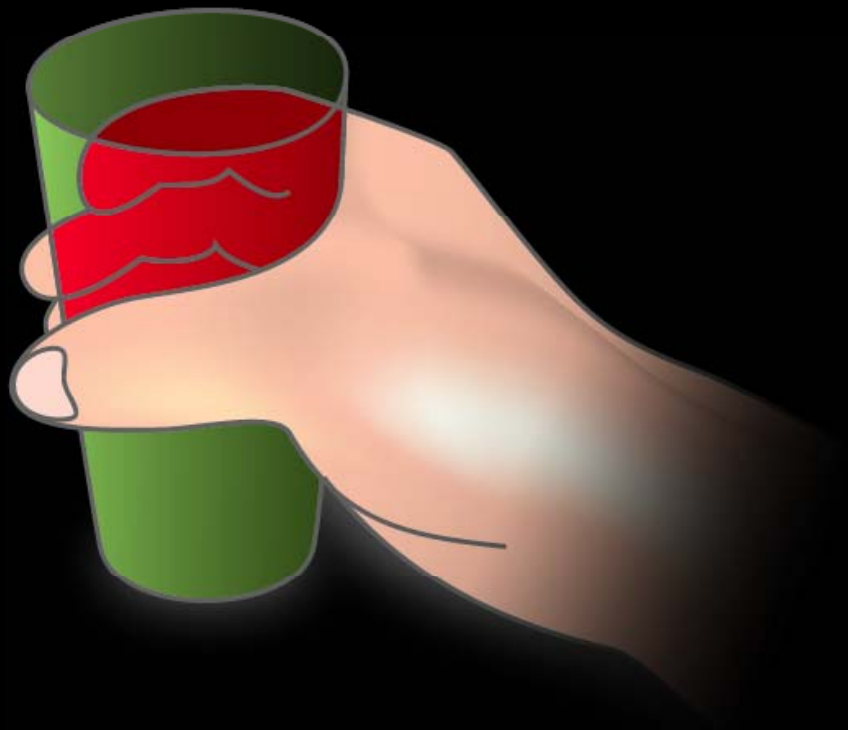
- Top-projector
  - Stereo at 120Hz
- Shutter glasses
  - Attached tracking receiver
- Tracking system
- Rear-projectors
  - LC shutters
  - Mirror

Rendering



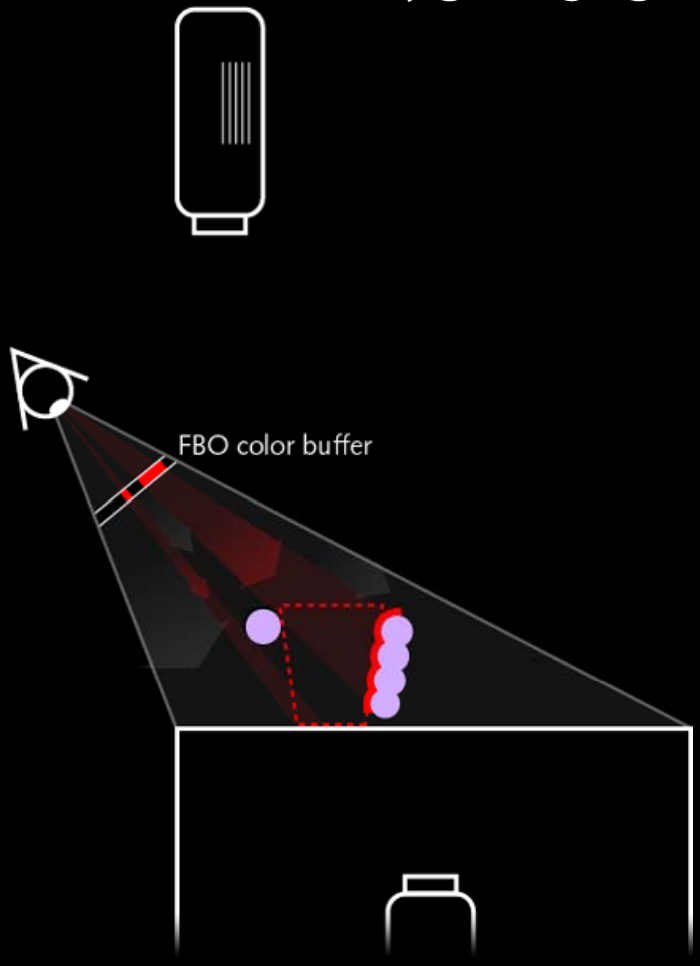
- Rear projection
  - The green part
  - Virtual objects only
  - Totally independent of the real objects
  - Off-axis stereo
  - Display result

Rendering (cont'd)



- Top projection
  - Parts of virtual objects that would occlude real ones (red)
  - Multiple render passes
  - Projective texture mapping
  - Display result

Rendering (cont'd)



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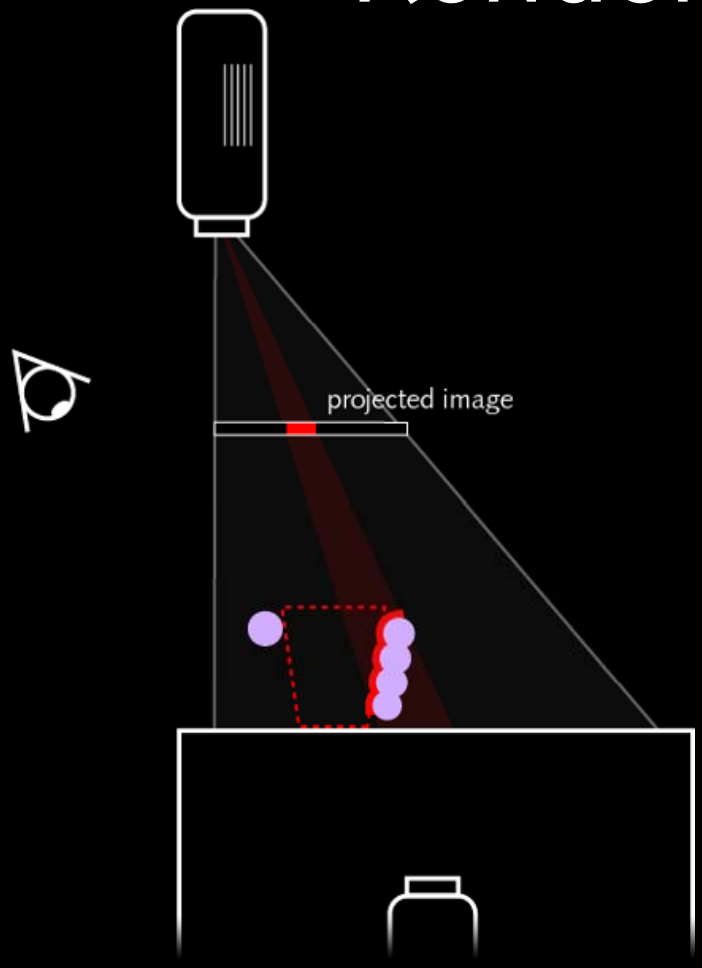

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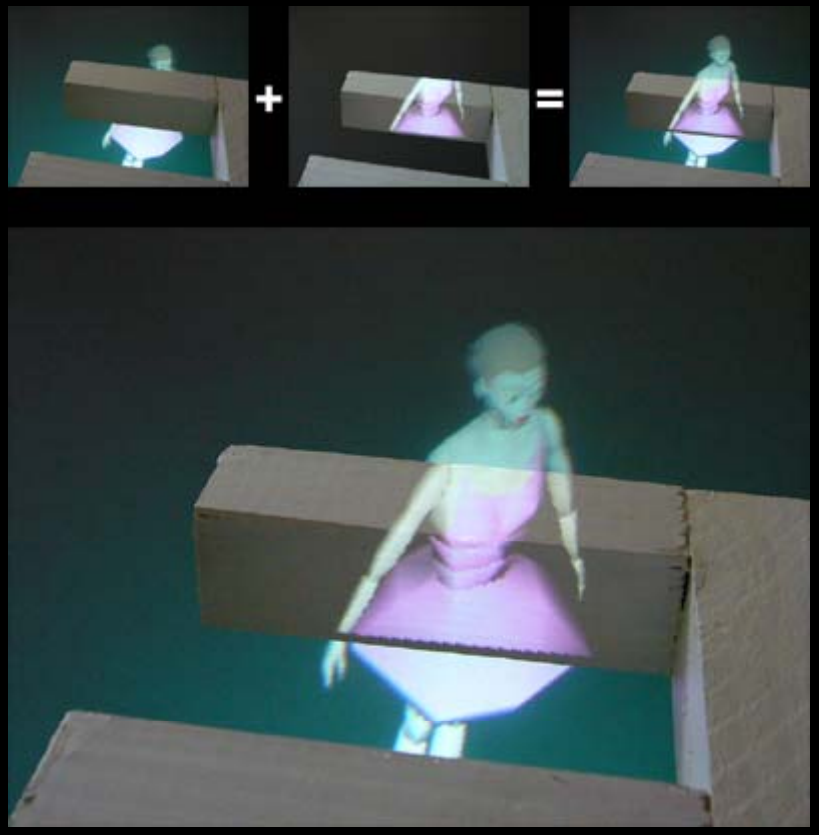
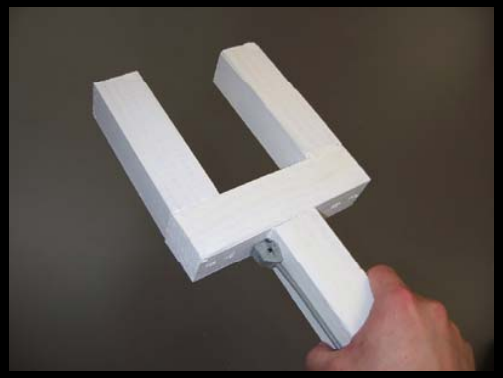
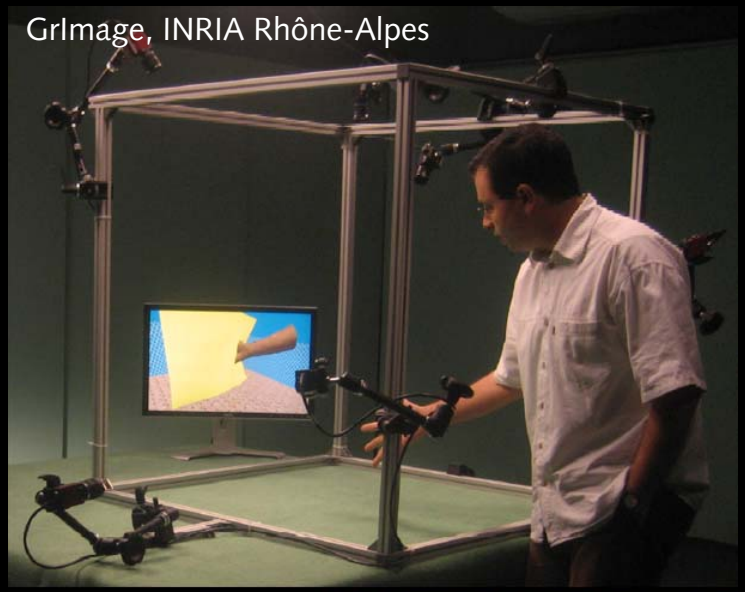
Applications



- Simple Occlusion Testing
  - Y-shaped tool in user‘s hand
  - Occlusions with virtual object (e.g. danseuse)

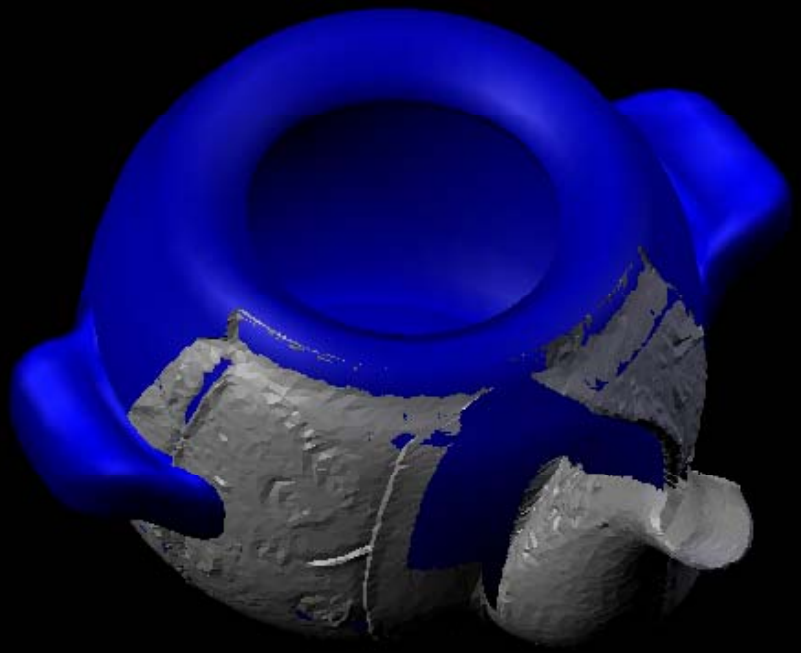


Applications (cont'd)



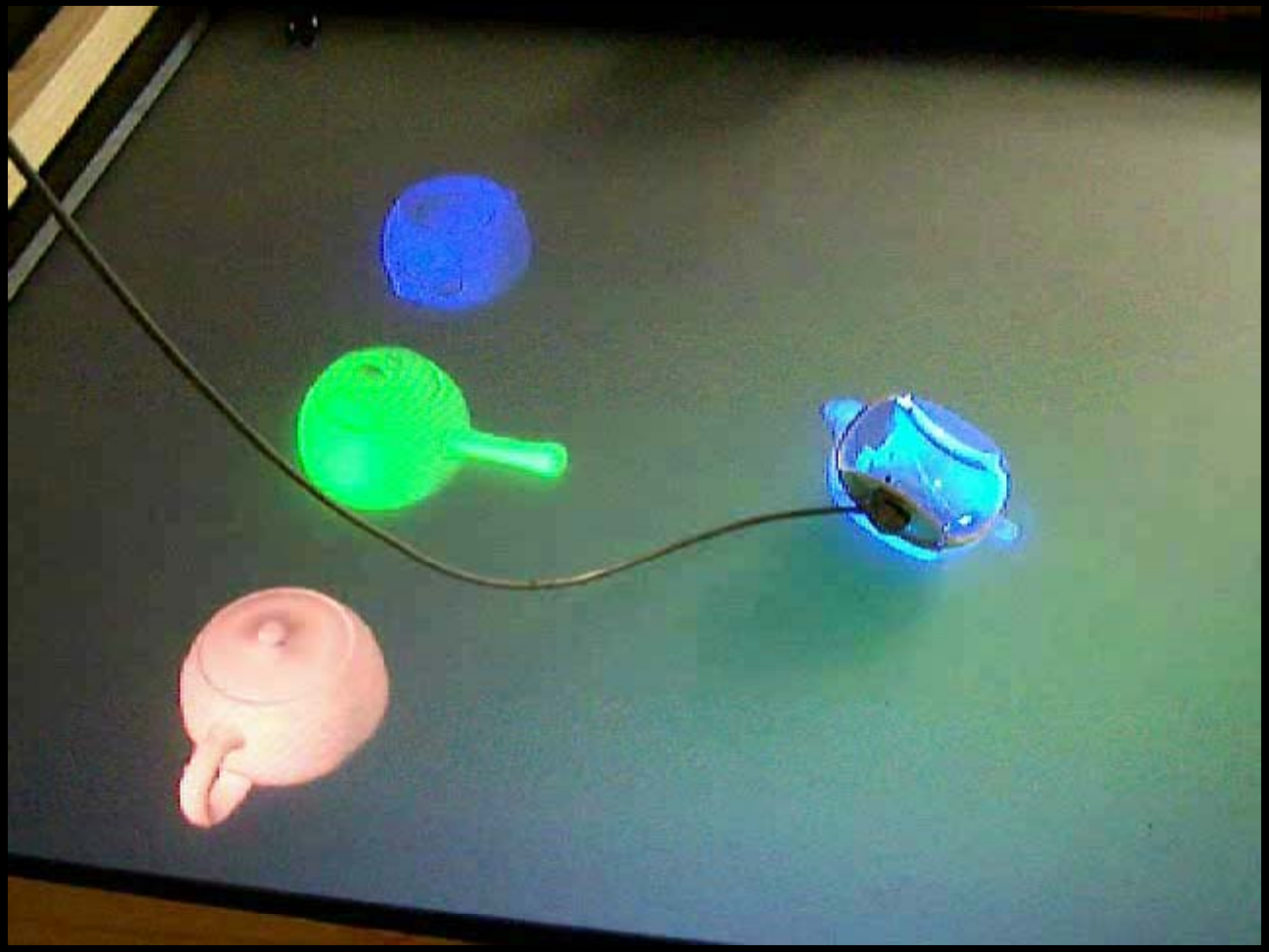
- Bare-hand Interaction
  - „Killer application"
  - Geometry of the hand must be captured
- Non-static illumination and environment
  - Imperfect reconstruction
  - Errors and artifacts
- Current tracking quality is not sufficient!

Applications (cont'd)



- Augmented Archaeological Finds
  - E.g. shard of a pot
  - What did the pot look like?
  - Modelling in clay is very static
- Approach
  - Scan 3d model
  - Augment a choice of possible contexts

Applications (cont'd)



Conclusions

- Approach
  - Projector-based
  - Mutual occlusions on Table-top displays
  - Mixed reality scenarios
- Proof-of-concept prototype
  - Approach works!
  - Limitations, problems and challenges
- Issues
  - Misregistration
    - Poor calibration
    - System latency
  - Surface reflectance properties
  - Shadow casts
- Future work
  - How can consistent occlusions support 3D user interfaces on table-top displays in MR?

Thanks for your attention!

Further information:

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