ISIS3D
PROJECTS AND APPLICATIONS

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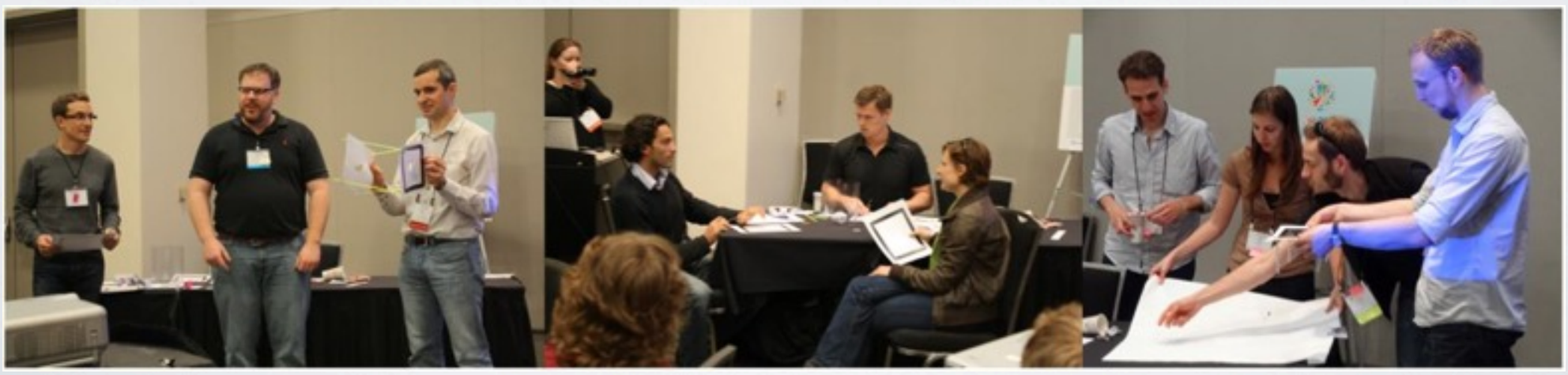
ISIS3D Tutorial @ ITS 2013, St Andrews

OUTLINE

- Recap of ISIS3D Part 1 - 3
- Some Related Projects
- Hardware & Products
- Application Scenarios
- Discussion

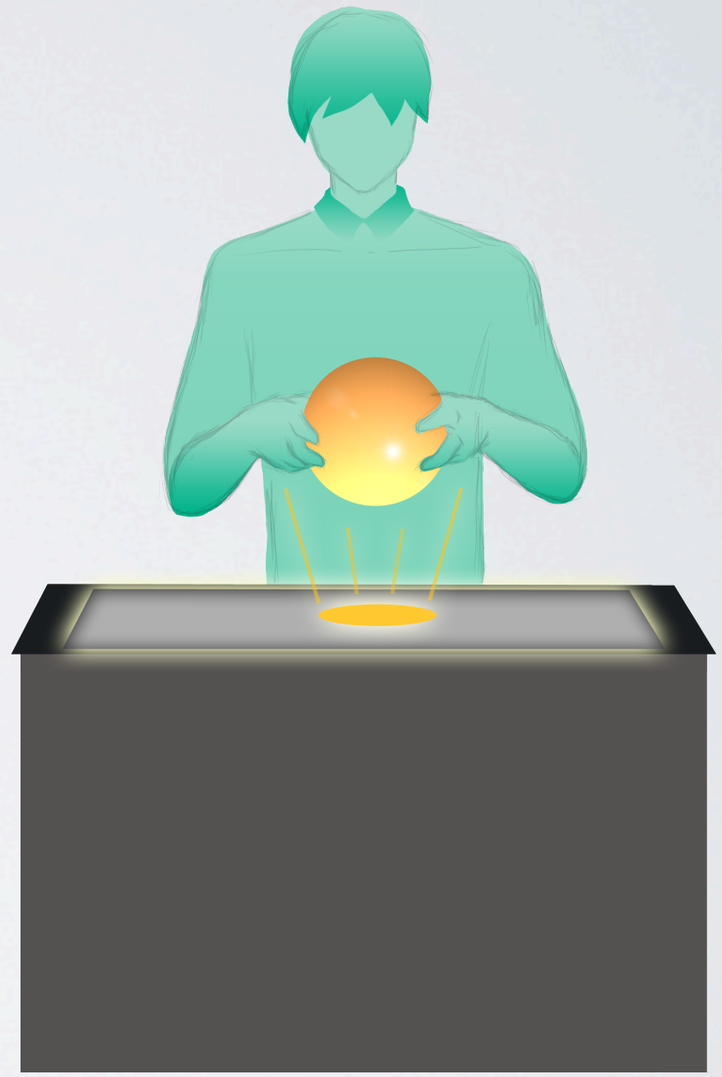
HISTORY OF T3D

- T3D SIG @ CHI 2011
- 3DCHI Workshop @ CHI 2012
- T3D Dagstuhl Seminar 2012
- SUI 2013
- ISIS3D @ ITS 20132013



RECAP

- Hardware for ISIS3D
- Perceptual issues of ISIS3D
- Interaction on and above the surface



CHALLENGES OF ISIS3D APPLICATIONS

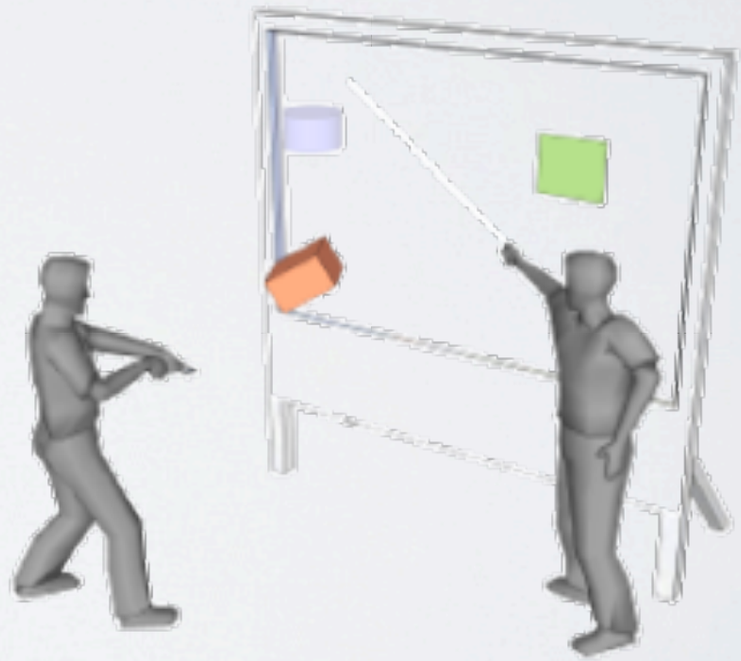
- How to interact with stereoscopic data on a 2D surface?
- How to interact with stereoscopic data in mid air?
- How to get in touch with different parallaxes?
- How to cope with perceptual issues?
- Which input/output devices?

RESEARCH PROJECTS

- **iMUTS** - Interscopic Multi-Touch Surfaces (DFG project)
- **InSTInCT** - Touch-based interfaces for Interaction with 3D Content (ANR project)
- **gravity + multitouch project** (HCI Group, HPI)
- **I3D** - Interactive 3D technologies (Microsoft Research)
- **SUI** (CVR, York University, Toronto)
- **3DI** - 3D Interaction group (Virginia Tech)
- **IV/LAB** - Interactive Visualization Lab (University of Minnesota)
- and few others ...

IMUTS

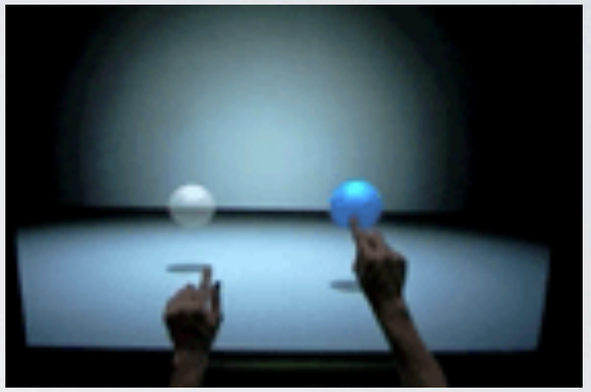
- Creating and evaluating interaction paradigms and models for stereoscopic projection surfaces.
- Combine both traditional 2D interaction and novel 3D interaction on a touch surface to form a new class of multi-touch systems.
- Design Space:
  - Parallax Paradigms
  - Manipulation
  - Navigation
- Interaction surfaces



INSTINCT

- Design, development, and evaluation of new simple and efficient touch-based interfaces for a new generation of interactive 3D applications, aimed in particular at general public audiences.

- Easy and efficient interaction with 3D content on touch-enabled screens.



http://anr-instinct.cap-sciences.net/

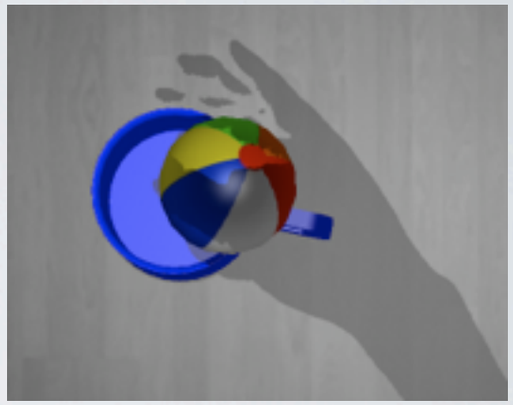
GRAVITY + MULTITOUCH

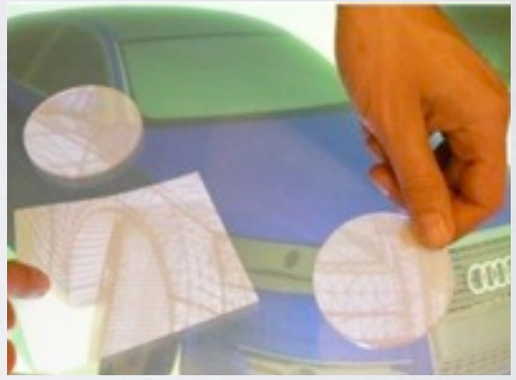
- gravity + multitouch = 3D tracking
- Investigates the concept of 3D reconstruction from 2D contact area:
  - fingers: ridgepad
  - tangible: lumino
  - people: multitoe
  - rooms: gravitySpace

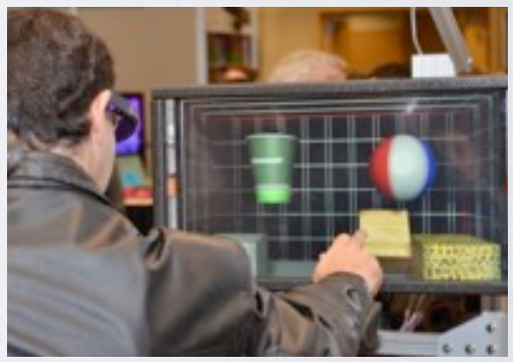
http://www.hpi.uni-potsdam.de/baudisch

I3D - INTERACTION

- I3D combines research on 3D graphics, computer vision, machine learning, novel hardware, augmented reality and NUI
  - Bringing physics to the surface
  - Going beyond the display
  - Interactions in the Air
- HoloDesk & TouchMover



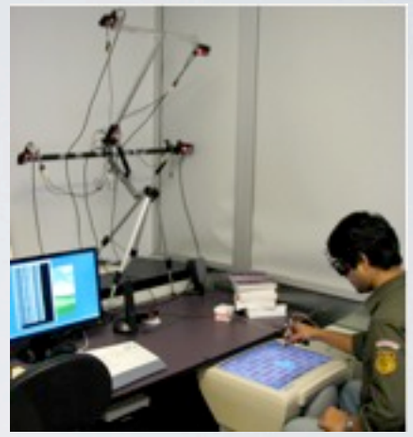


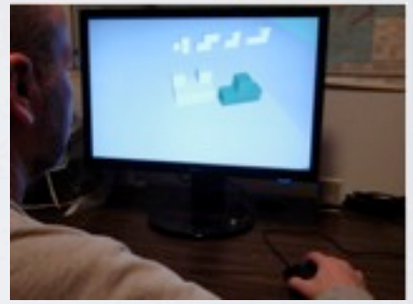


http://research.microsoft.com

SUI

- 3D and Spatial User Interfaces
- Investigating user interfaces for interactive 3D systems, where users can easily select and manipulate 3D content.
  - Towards Better 3D Input Devices
  - Slide
  - SESAM





http://www.cse.yorku.ca/~wolfgang/

3DI - MIGRATION PROJECT

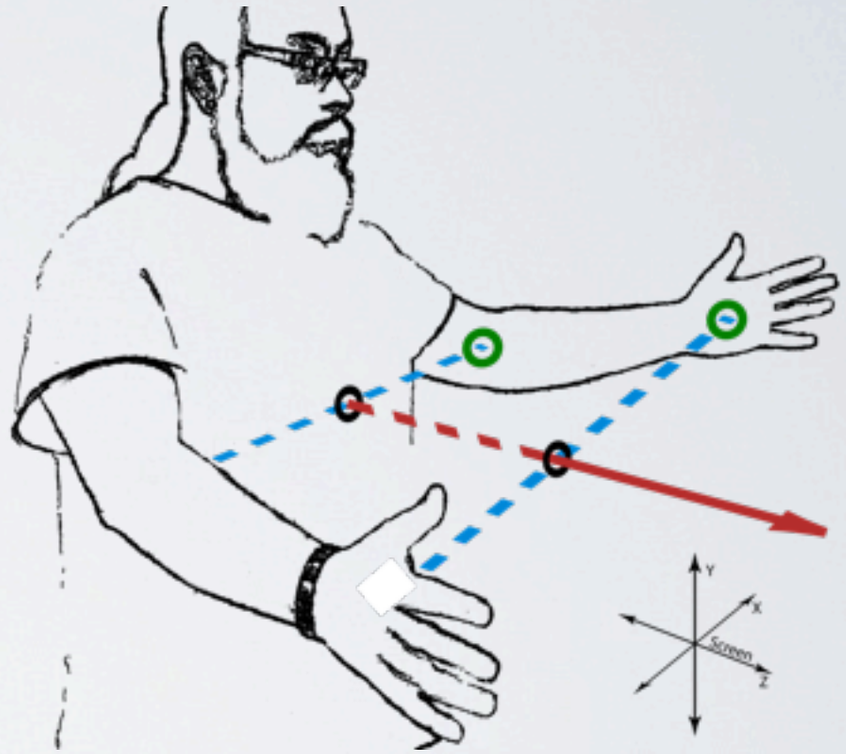
- Migration of manipulation techniques for commodity tracking systems

- Well-known manipulation techniques migrated to Kinect and Move

  - ray casting

  - HOMER

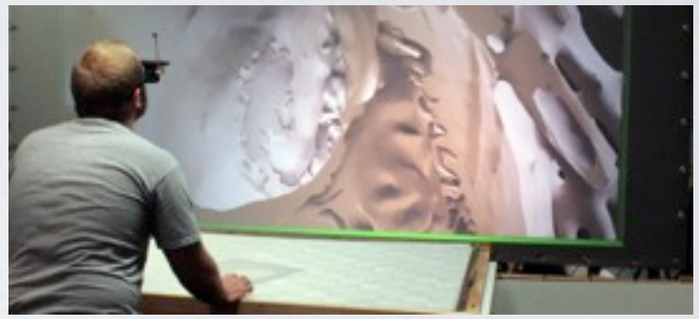
  - World-In-Miniature

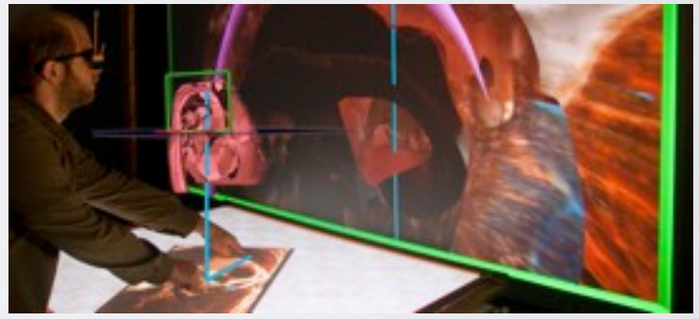


http://research.cs.vt.edu/3di/

IV/LAB - MULTI-TOUCH WIM

- IV/LAB investigates 3DUIs from a visualization perspective.
- Research on multi-touch interaction with volumentric data.
  - Slice-WIM
  - Shadow-WIM



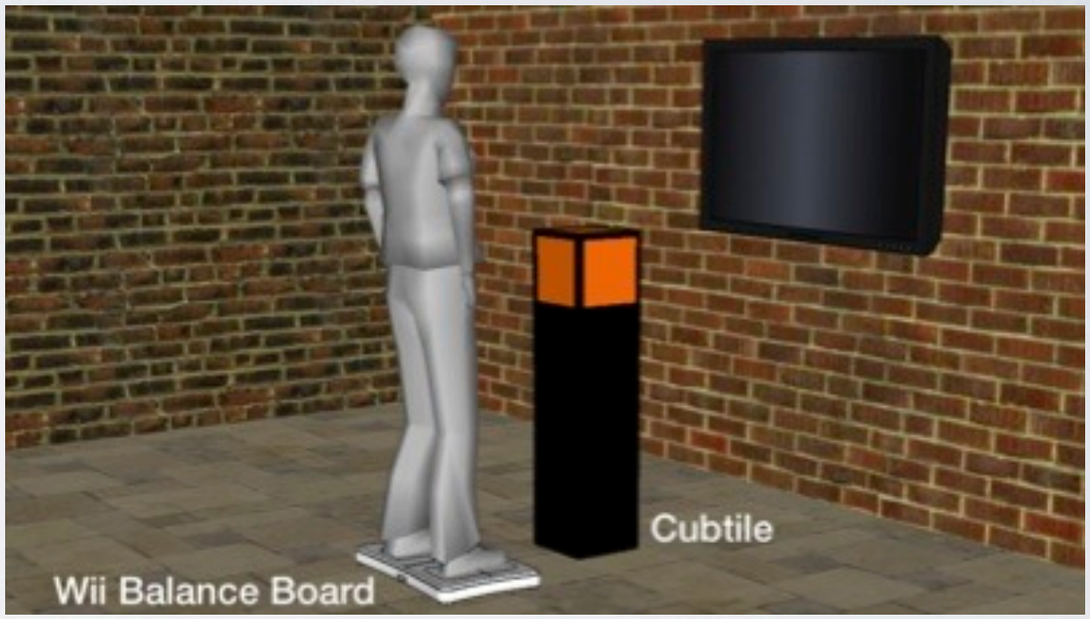


http://ivlab.cs.umn.edu/

HARDWARE & PRODUCTS

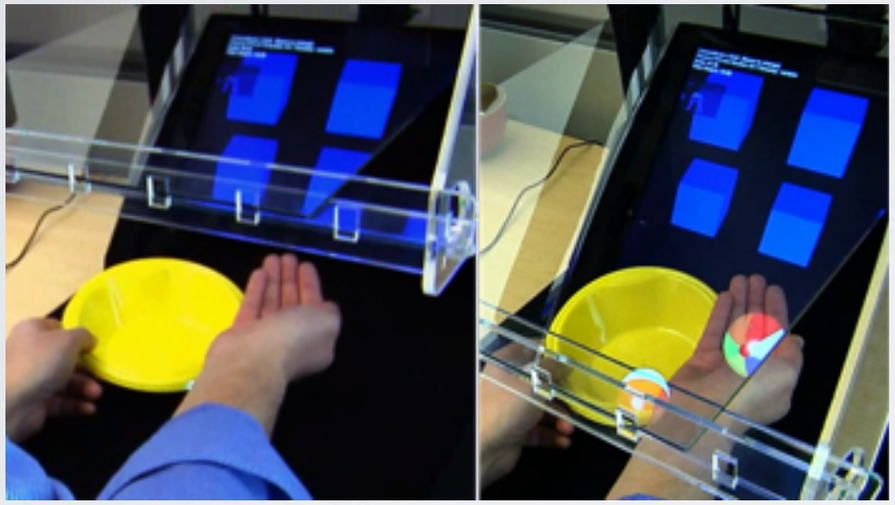
From Sci-Fi to (R&D) Hardware to Off-the-Shelf Products

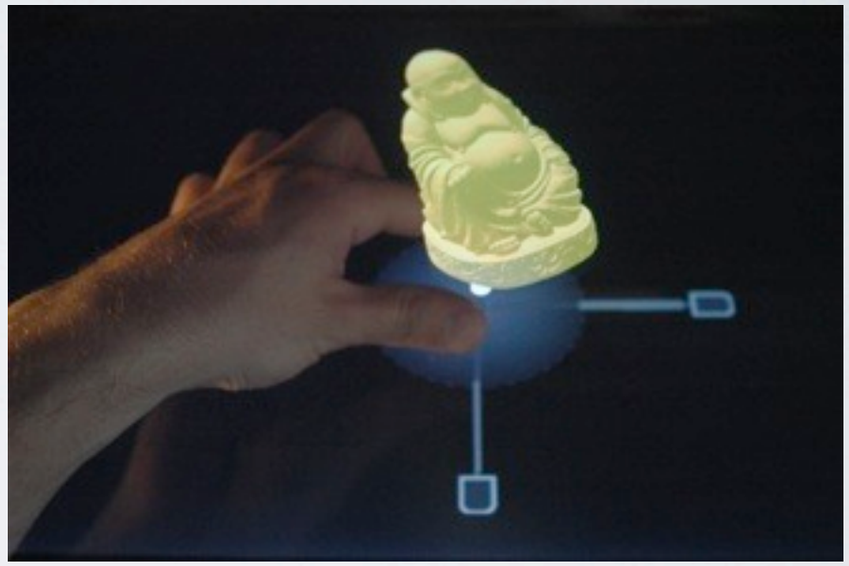
CUBTILE & HOLOCUBTILE

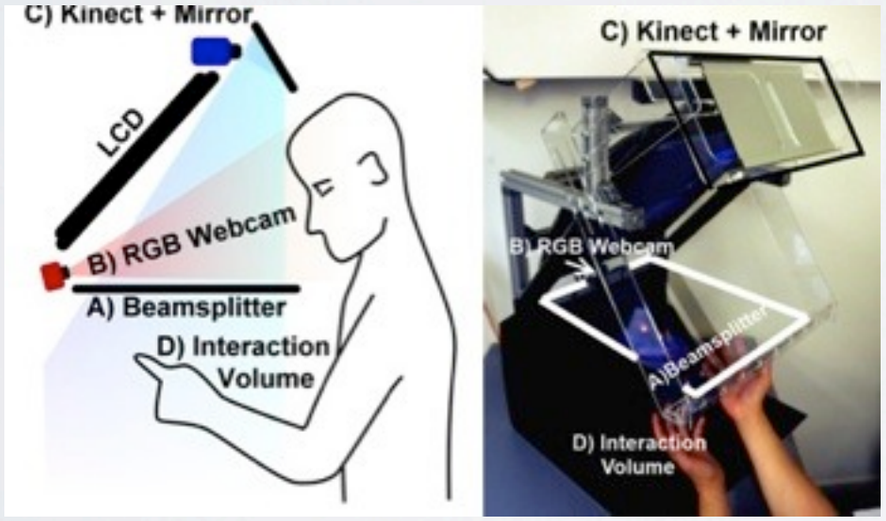


http://www.immersion.fr

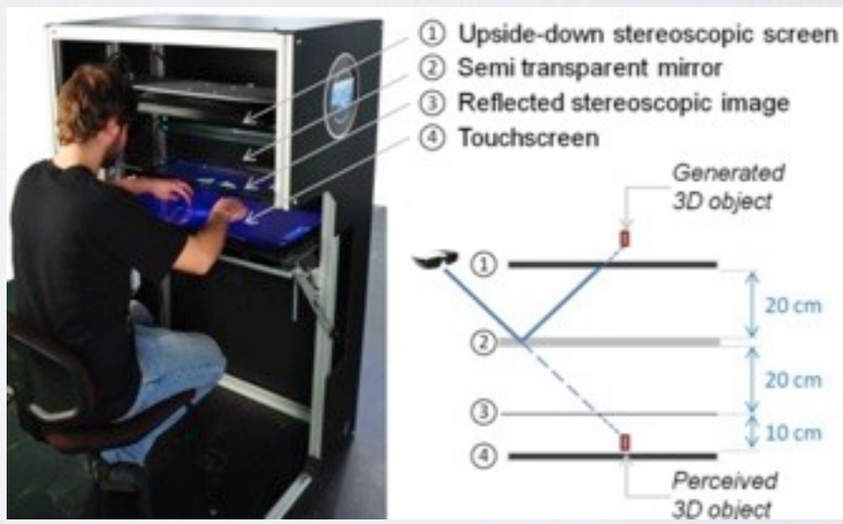
HOLODESK & TOUCHEO







http://research.microsoft.com/en-us/projects/holodesk/

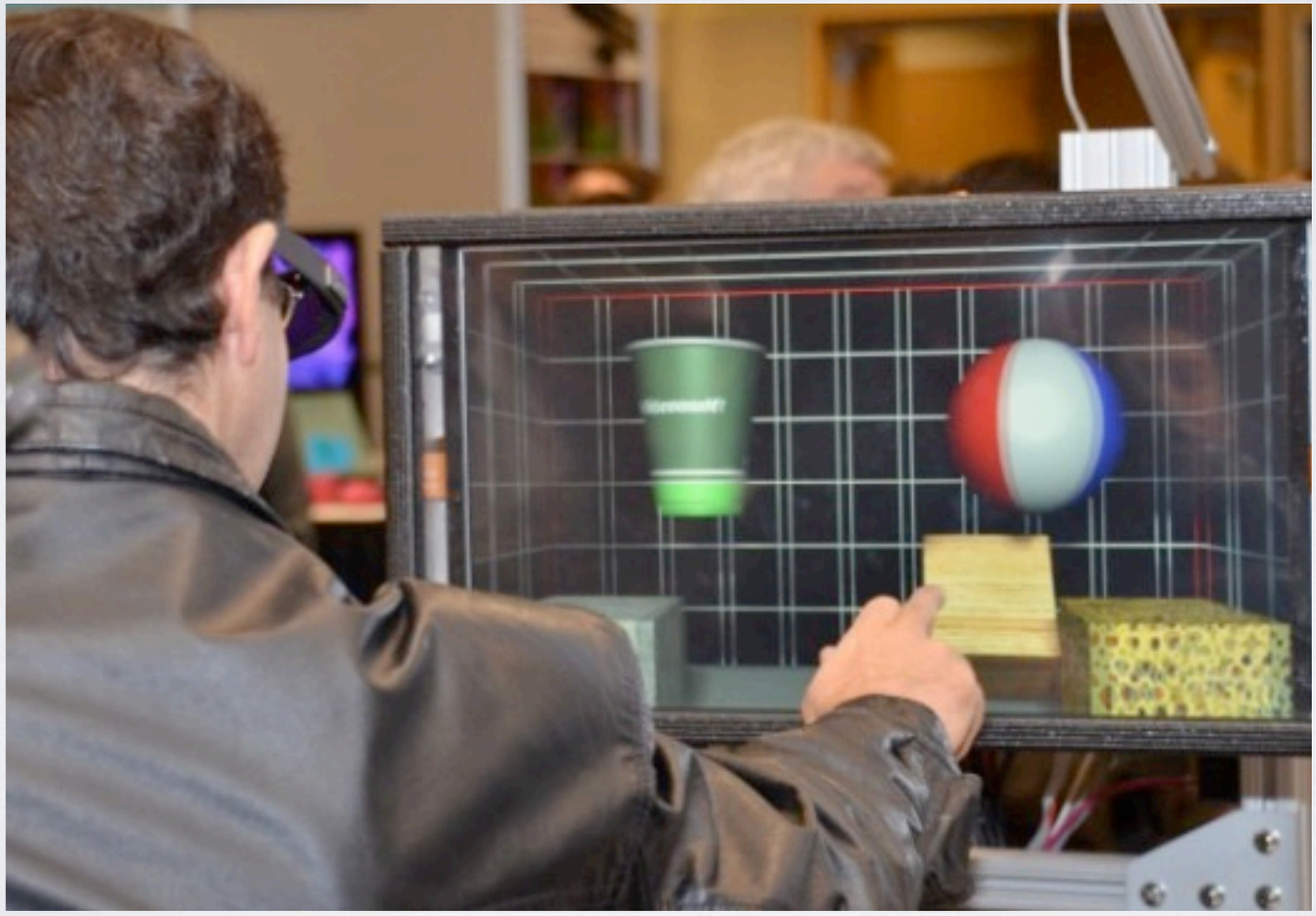


http://hal.inria.fr/inria-00612505

ILIGHT 3D TOUCH

TOUCHMOVER

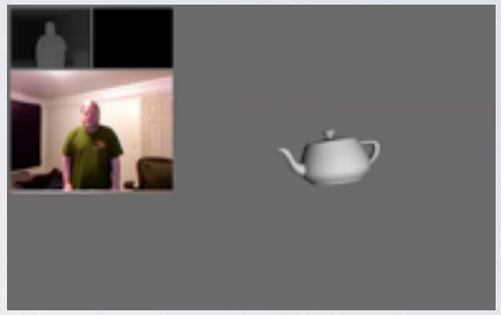
Will be presented at ITS 2013 \o/



http://www.extremetech.com/computing/150110-microsoft-research-shows-off-force-feedback-3d-touchscreen

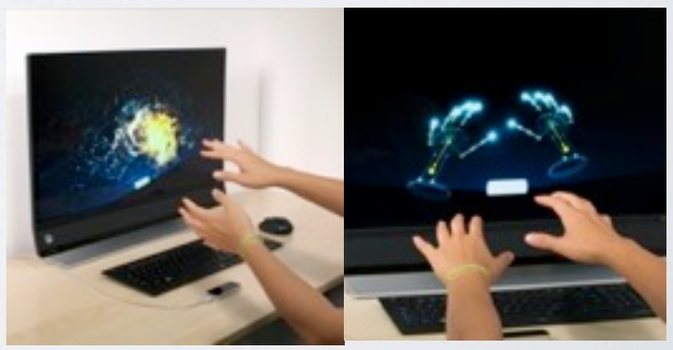
RGB-D CAMERAS & DEPTH SENSORS

- Affordable 3D Tracking
  - RGB-D cameras, e.g.
    - Kinect
    - Primesense
- Other depth sensors, e.g.
  - Leap Motion



http://vimeo.com/17045326

http://www.primesense.com/

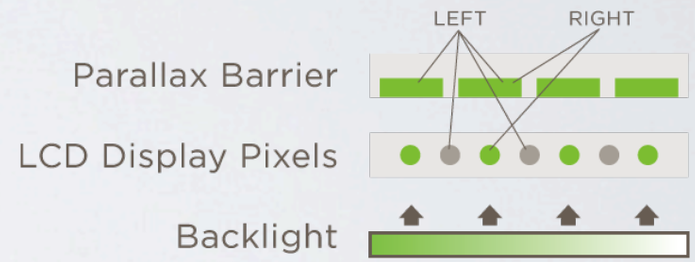


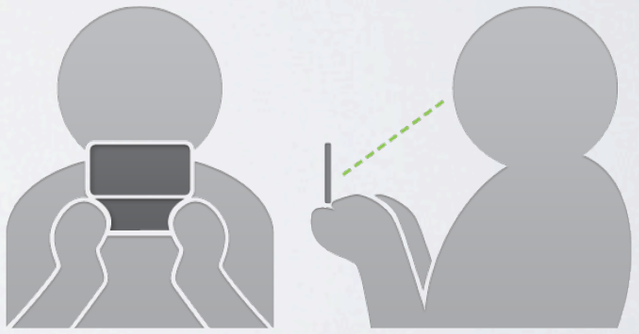
https://www.leapmotion.com

AUTOSTEREOSCOPIC MOBILE DEVICES

AUTOSTEREOSCOPIC MOBILE DEVICES

- Only few mobile devices that support auto stereoscopy so far.
  - HTC Evo 3D
  - LG Optimus 3D
  - Nintendo 3DS
- Properties:
  - Parallax barrier technique
  - Fixed viewing distance
- Each manufacturer ships his own proprietary 3D SDK!
  - LG Real 3D SDK
  - HTC Stereoscopic 3D API
  - Both do not provide rich APIs





http://htcdev.com/

APPLICATION SCENARIOS

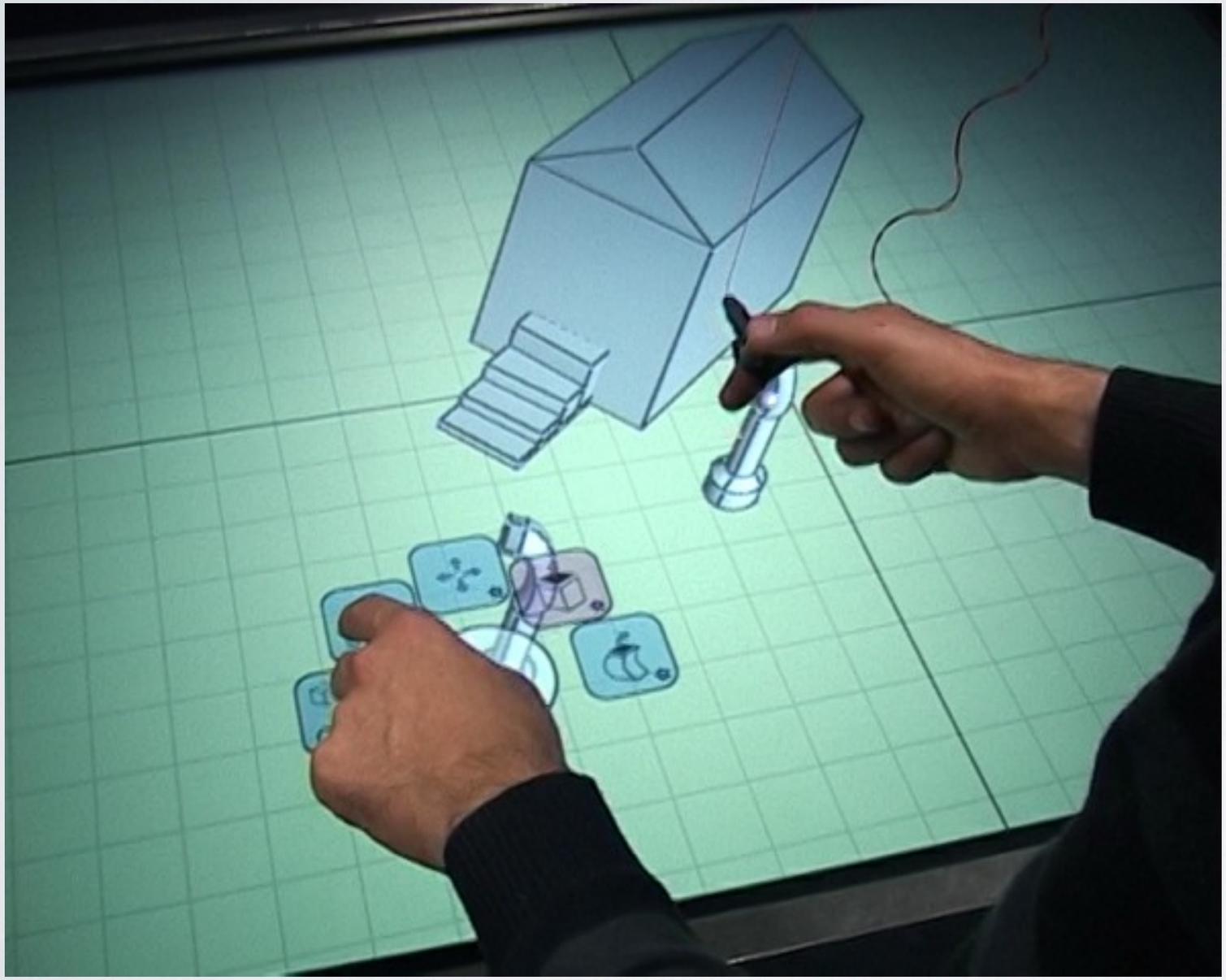
- Research
- 3D Modeling
- Medical applications
- Geospatial applications

- Mobile 3D Interaction
- Interactive 3D Home Entertainment

APPLICATION SCENARIOS

- Projects envision the following application scenarios:
  - iMUTS:
    - Addressing the geospatial and medical domain.
  - InSTInCT:
    - Aiming for 3D Applications for museums, schools, artists, archaeologists …
    - ... but also 3D modeling.
  - ...

3D MODELING

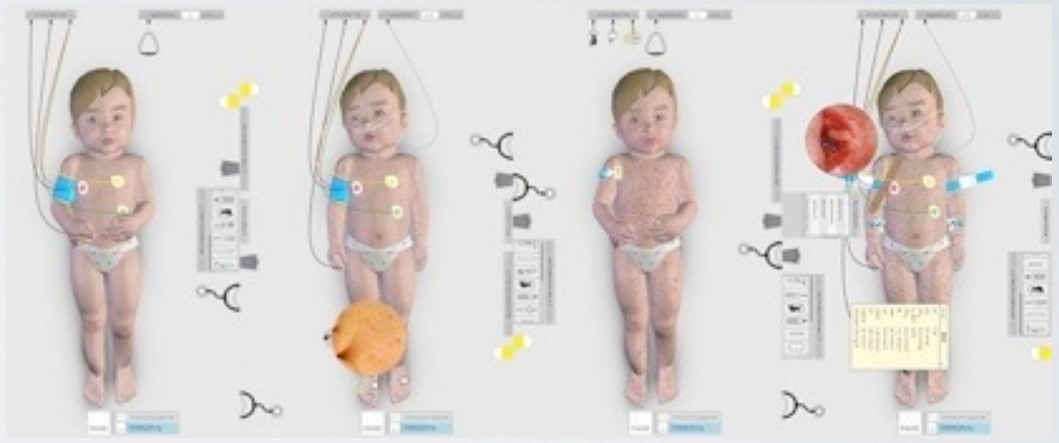


http://www.ikea.com

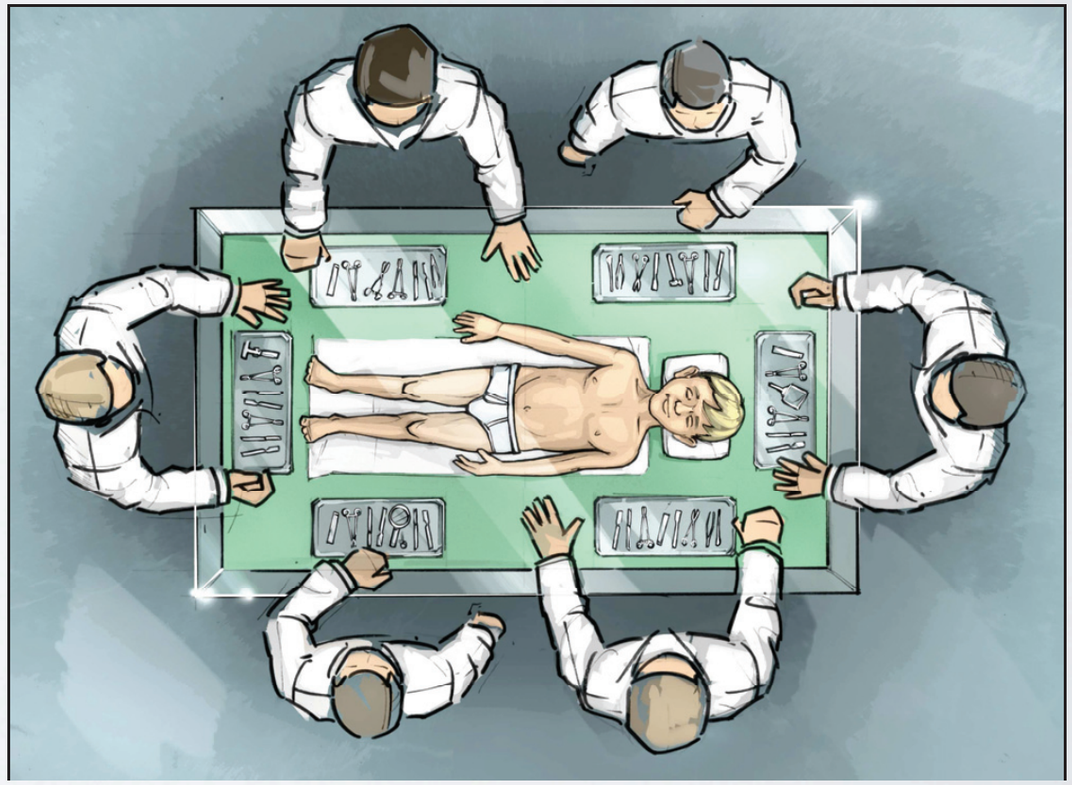
http://viscenter.dfki.de

MEDICAL APPLICATIONS

- Learning
- Examination
- Surgery

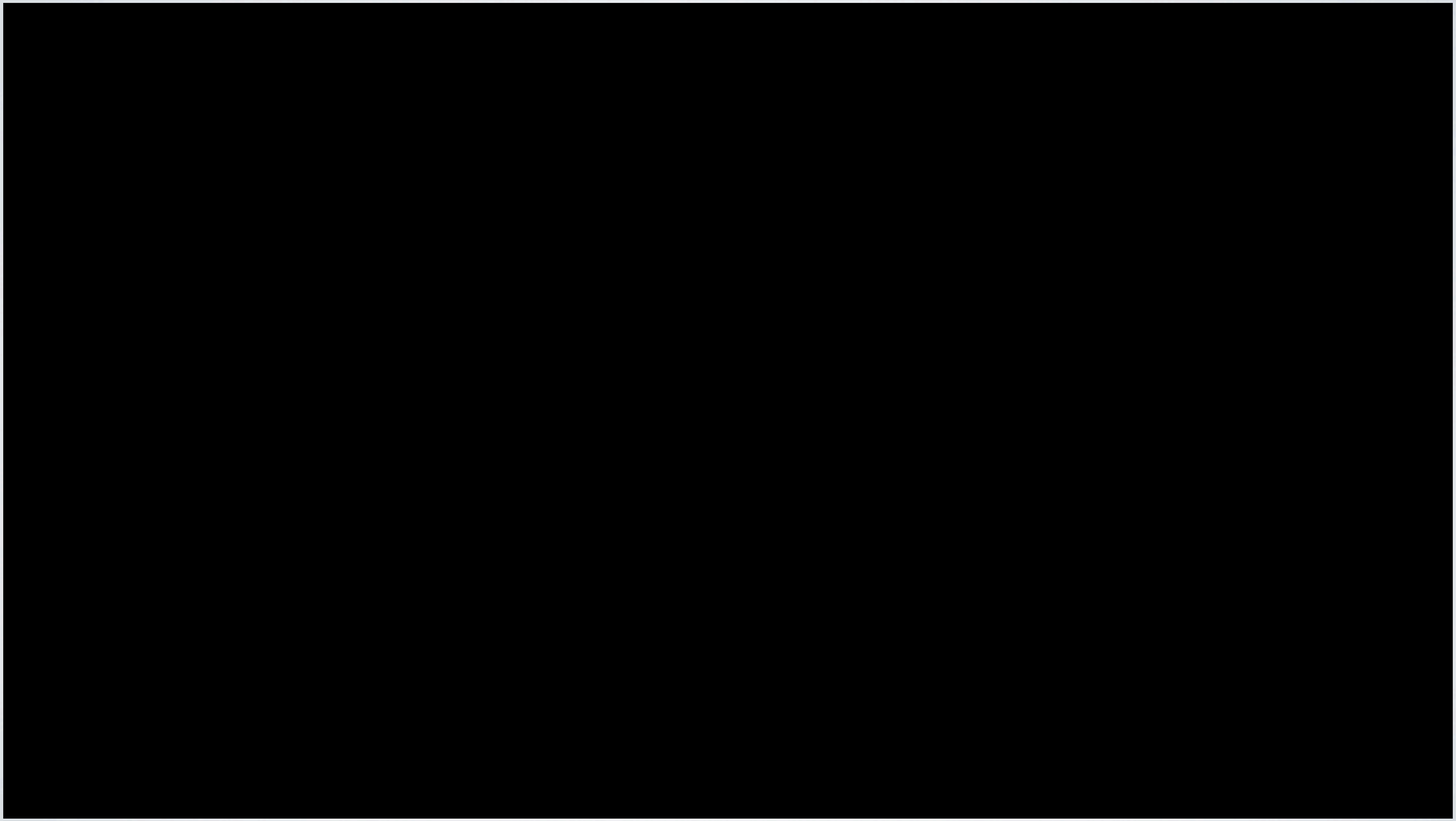


http://www.gizmowatch.com/entry/six-best-kinect-medical-hacks/



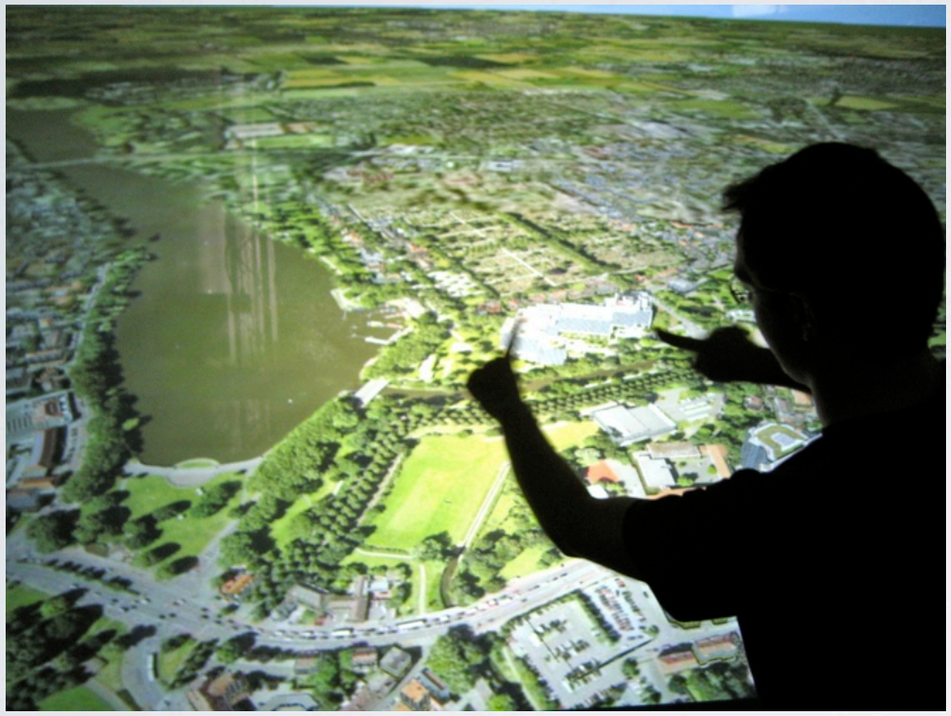
http://elearning.charite.de/projekte/simmed/

MEDICAL APPLICATIONS

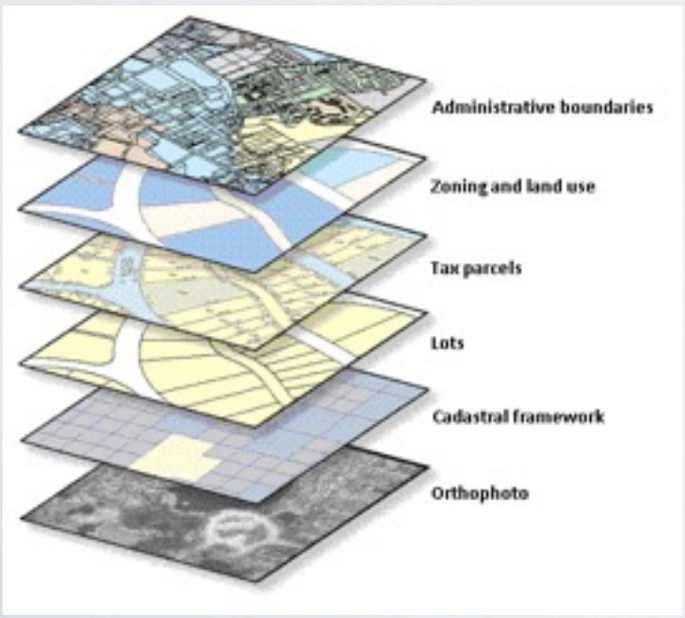


http://youtu.be/1dc8G5ITVtI

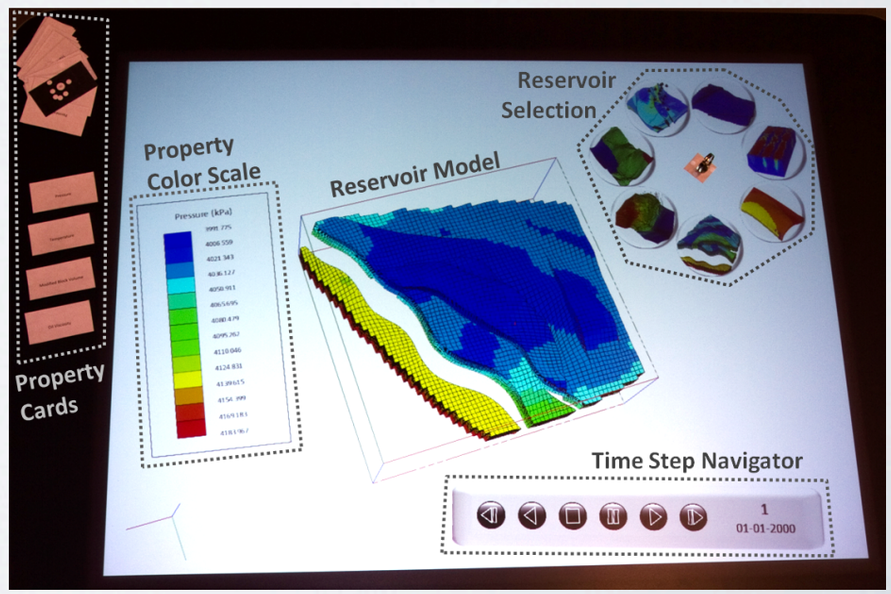
GEOSPATIAL APPLICATIONS



http://youtu.be/RebX7YEn3GQ



http://www.esri.com



Sultanum et al. 2010

MOBILE 3D APPLICATIONS

- Mobile 3D Interaction
- Mobile Games
- Augmented Reality

MOBILE 3D INTERACTION

- Properties:
  - Interaction with stereoscopic data displayed on mobile devices
  - Navigation through and manipulation of objects in 3D on the mobile device.
  - Different sensors as input modalities.
- Issues
  - Interaction can break stereoscopic effect!
  - Mobile 3D interaction design is critical!
  - But some ergonomic issues still remain.

MOBILE 3D GAMES (1)

- Commercial stereo-3D games available
- 2,5D extended to stereo 3D
- Fixed holding position for stereo effect
- Game controllers or game controller-like Soft Buttons

„For stereoscopic 3D playing it's best to use this game with the N64 controls as you'll want to hold the unit steady to preserve the illusion of depth!“ Starfox 64 3D for 3DS

MOBILE 3D GAMES (2)

- Developing for mobile stereo:
  - Reduction to anaglyph stereo,
  - Reduction of interactions,
  - ...
- But still very interactive and fun!

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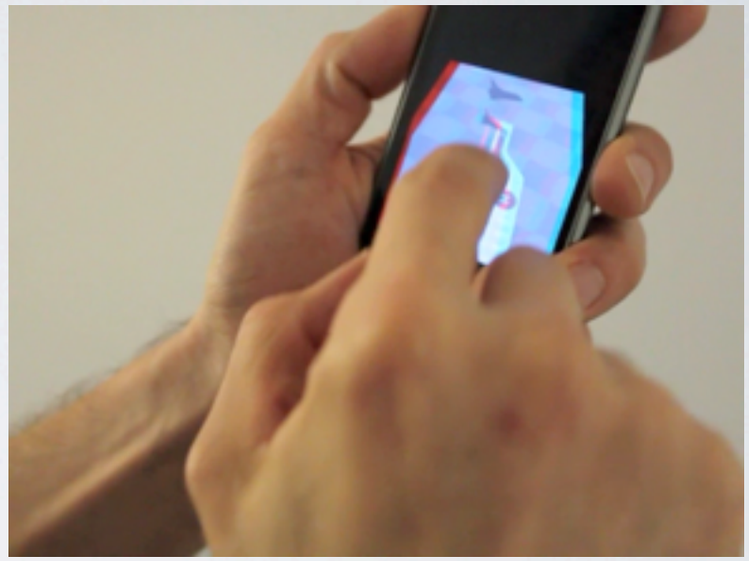

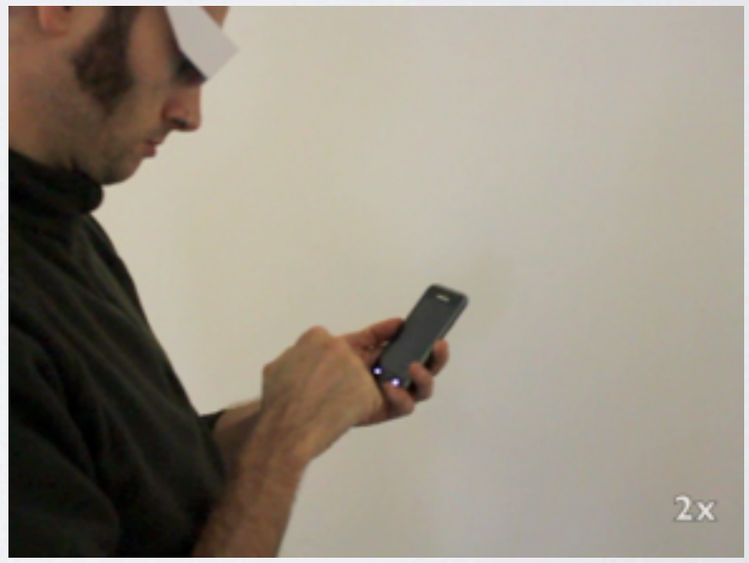

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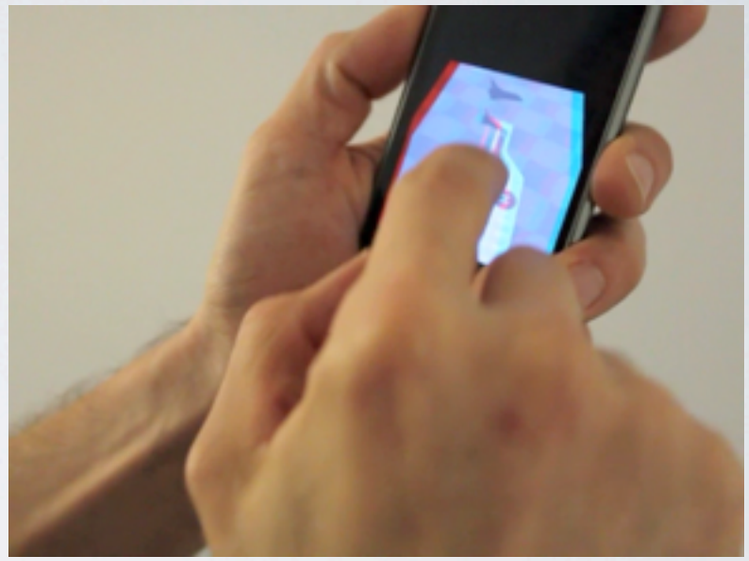
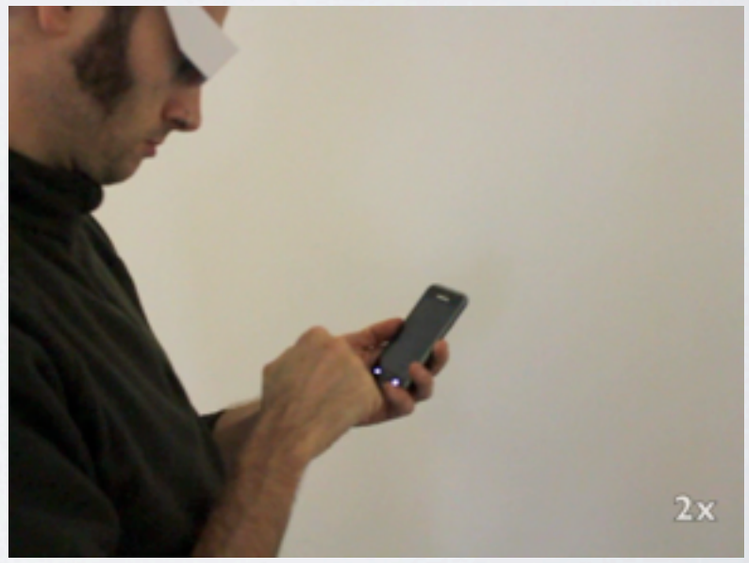




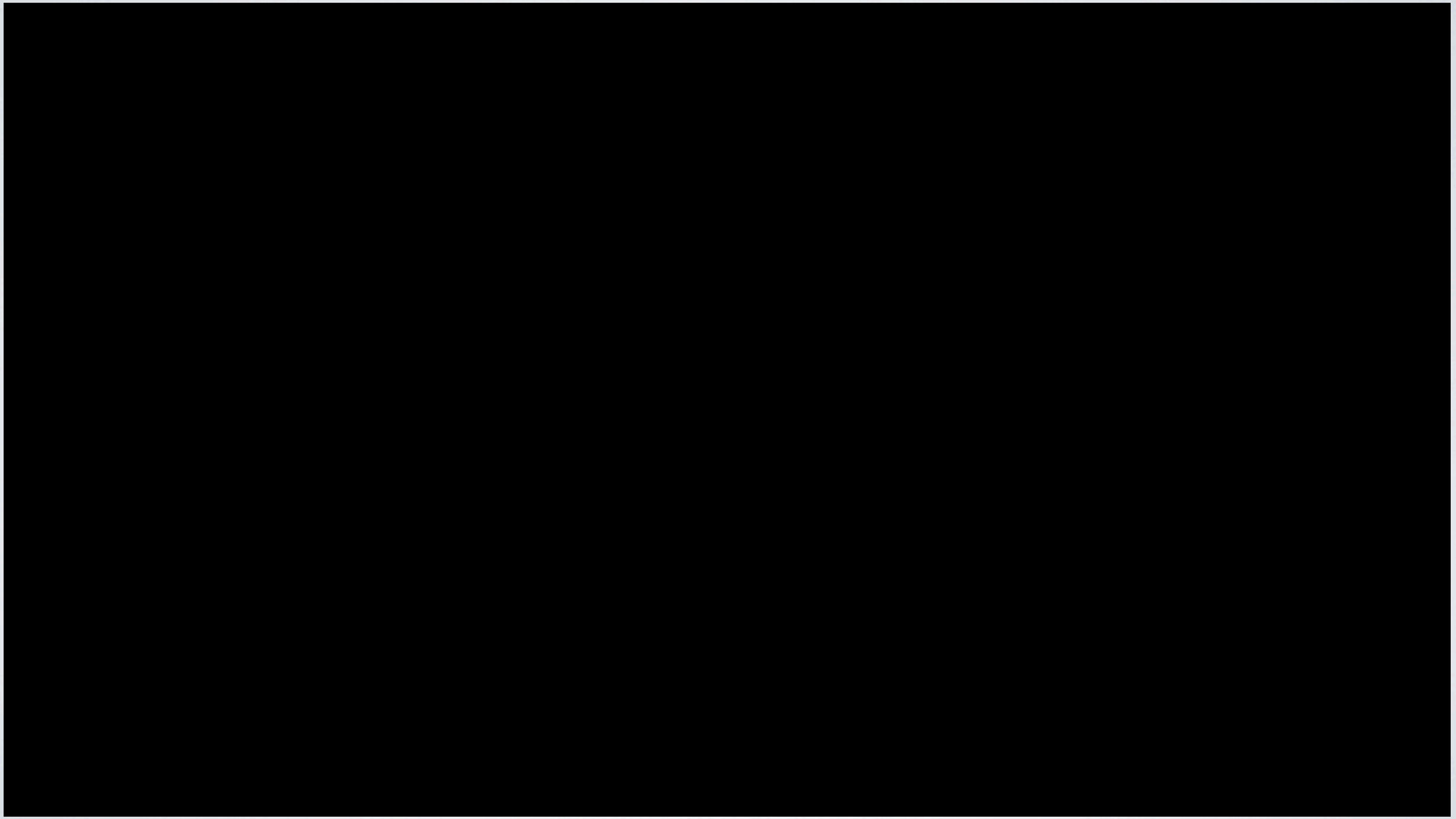
MOBILE AUGMENTED REALITY

- Mobile Augmented Reality (AR) in stereo?!
- Motivation:
  - Registration of AR objects to real world object difficult.
  - This is a problem in particular for distant objects.

MOBILE AR EXAMPLE (1)

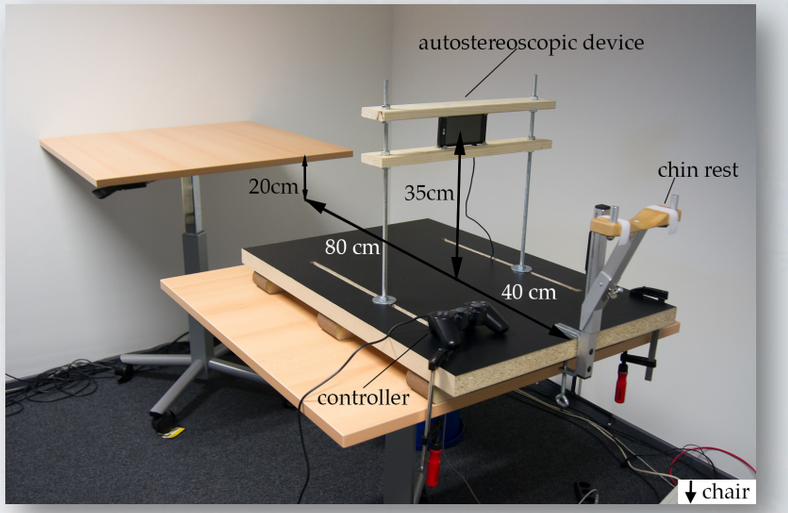
- LG Optimus 3D Max with Android 2.3.6
- 6 DOF tracking with OptiTrack system (device position and orientation)
- Rendering of stereoscopic camera image and virtual objects via OpenGL ES 2.0

MOBILE AR EXAMPLE (2)



MOBILE AR STUDY (1)

- 12 participants with normal or corrected to normal vision (mean age = 25.3)
- Fixed setup
- Task: „Decide which of the cubes is closer to you.“
- 4 conditions:
  - Random cube size vs. fixed cube size
  - Autostereoscopy on vs. autosteroscopy off



MOBILE AR STUDY (2)

- Method & Goals:
  - Find minimal distance between cubes at which a discrimination in depth becomes possible
  - Adaptive staircasing procedure with several hundred trials per user in 2-3 sessions
  - 7 different base depths were considered (3 in negative parallax, 4 in positive parallax)

MOBILE AR STUDY (3)

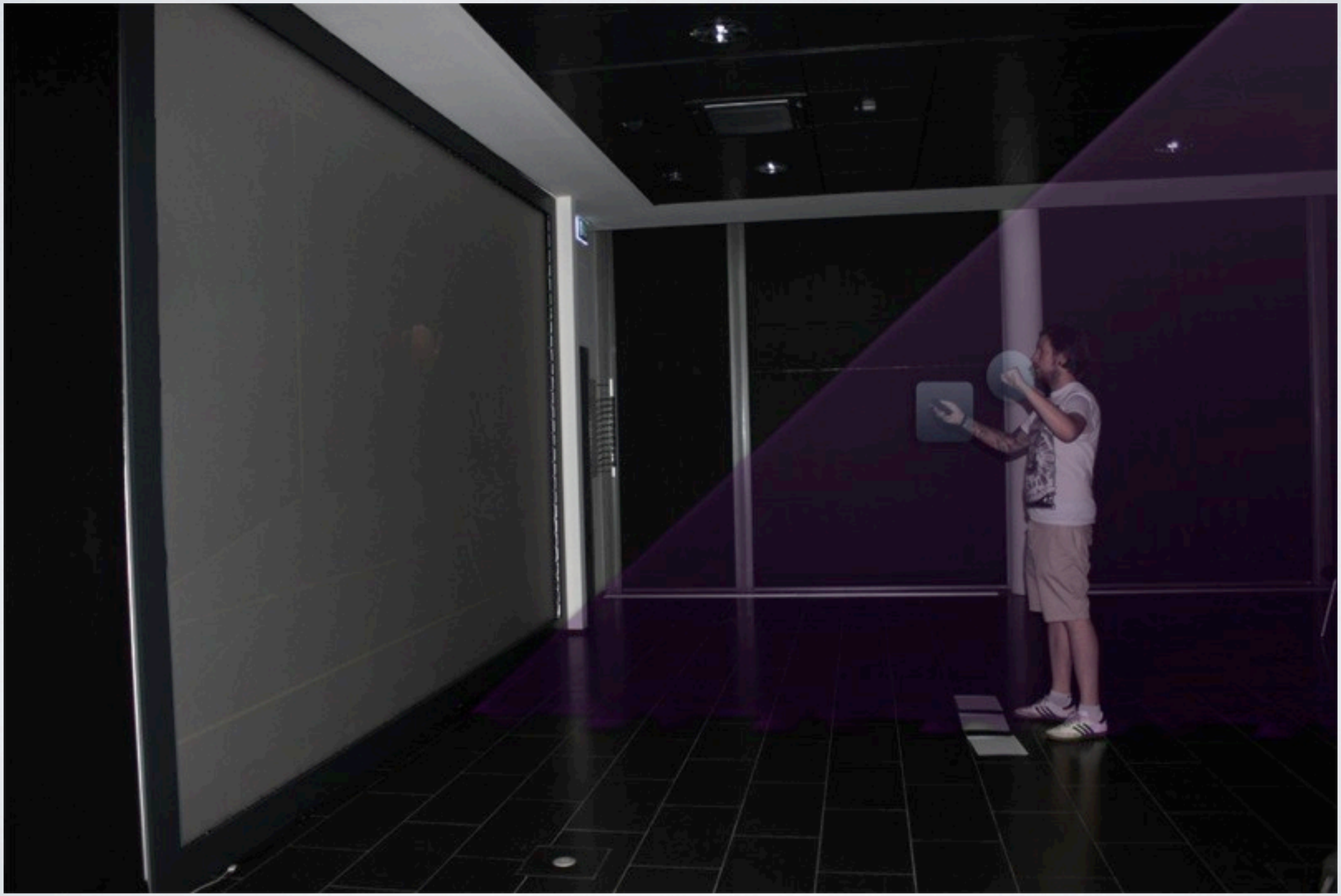
- Results:
  - High variance across participants
    -> No clear discrimination range found
  - Size cue is dominant over autostereoscopic cue
    -> Objects with known size can be better discriminated
    - Discrimination in negative parallax better than in positive parallax
      -> Not of interest for AR applications
- Future Work:
  - Repetition of user study with different devices (not necessarily smart phones)
  - Field study without optical tracking setup
  - Further research regarding additional depth cues needed.

3D HOME ENTERTAINMENT

3D ready living room: 3D TV + Kinect + Smart Phone

http://research.microsoft.com/en-us/projects/illumiroom/

3D HOME ENTERTAINMENT



DISCUSSION

- Trending commercial topic:
  - 3D Cinema and TV, 3D Games
  - Novel input devices extend the interaction space at home
- Trending research topic:
  - New symposium: SUI
  - Market-ready devices entice researchers to revisit spatial interaction
  - While multi-touch is supposed to enable NUI, ISIS3D might be another potential candidate!?

CONCLUSION

- Trending topic #ISIS3D ;-)
- What‘s next?
- Killer App?

http://www.flickr.com/photos/mcdemoura/2209997514/

ISIS3D WORKSHOP

ITS 2013, St Andrews

PART I POSITION PAPERS

- Tutorial Part 4
- Perception
- Studying ISIS3D
- Applications and Systems

http://www.flickr.com/photos/mcdemoura/2209997514/

PART 2 DISCUSSION

- Please take notes what you like to discuss in the second part