envision the office of the future

Samuel Koch - 17/01/18

R. Raskar, G. Welch, M. Cutts, A. Lake, L. Stesin, and H. Fuchs, "**The office of the future: A unified approach to image-based modeling and spatially immersive displays**," in Proceedings of the 25th annual conference on Computer graphics and interactive techniques, 1998, pp. 179–188.

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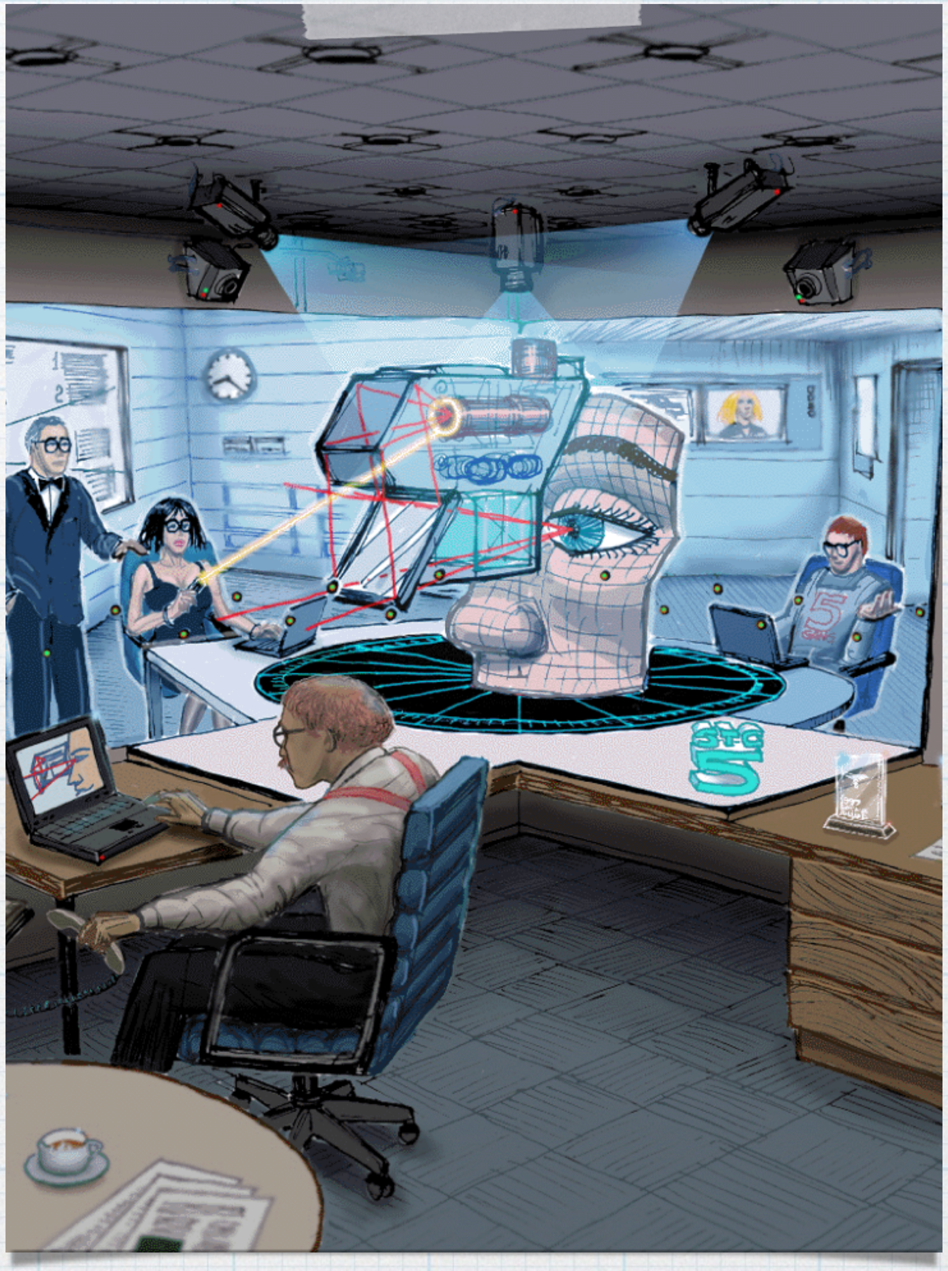
A. Maimone and H. Fuchs, "**A First Look at a Telepresence System with Room-Sized Real-Time 3D Capture and Life-Sized Tracked Display Wall**," Department of Computer Science, University of North Carolina at Chapel Hill.

vision

* shared collaboration (telepresence)
* immersive virtual environment
* through-the-window paradigm
* freedom of movement (natural interaction)
* spatially immersive displays

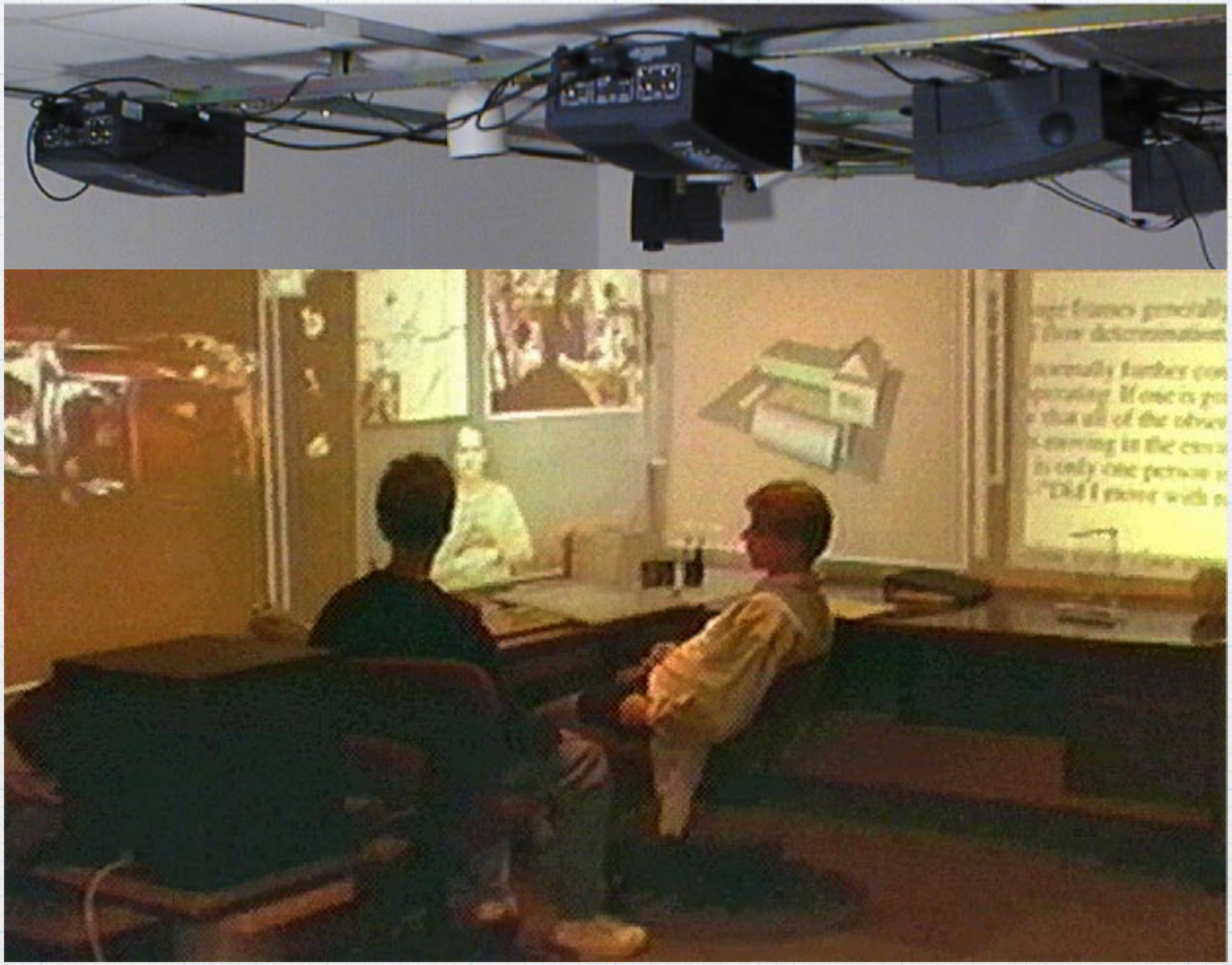


The office of the future,
R. Raskar et al., 1998

kick off ideas

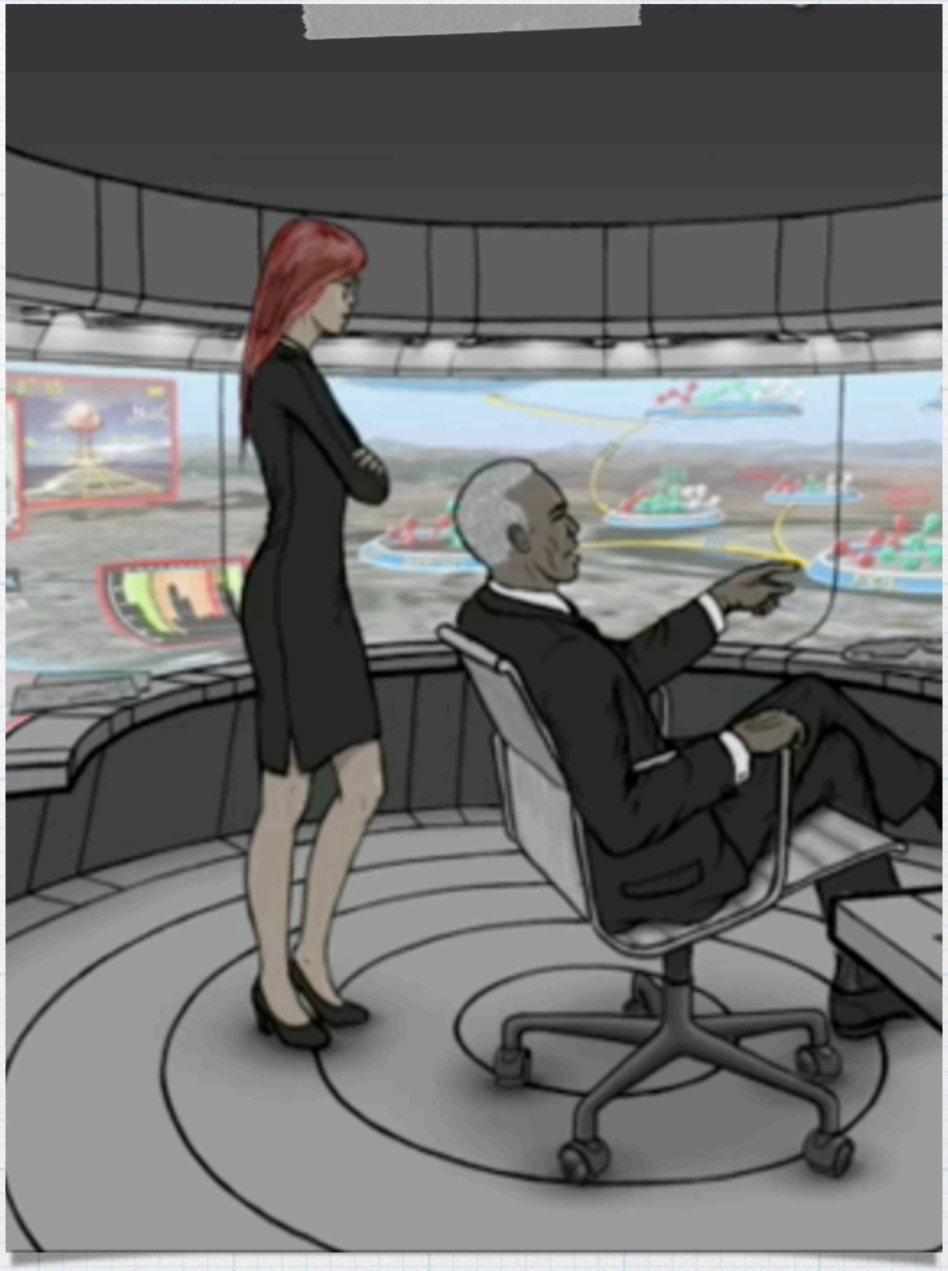
* image-based reconstruction of the remote office
* use imperceptible lights to extract a 3D scene
* usage of several cameras
* autocalibrate designated display surfaces

setup



methods & tools

* spatially immersive displays
* dynamic image based modelling
* imperceptible structured light
* rendering & displaying



The office of the future,
R. Raskar et al., 1998

spatially immersive displays

* get the display off of the user's head
* telepresence
* 3d projection technology
* projectors synchronously shuttered along with screens
* virtual environment

dynamic image-based modeling

* goal: capturing models of environment
* requirements: high accuracy, high update rates, non-intrusiveness
* depth extraction
* video camera & projector (in a pair)

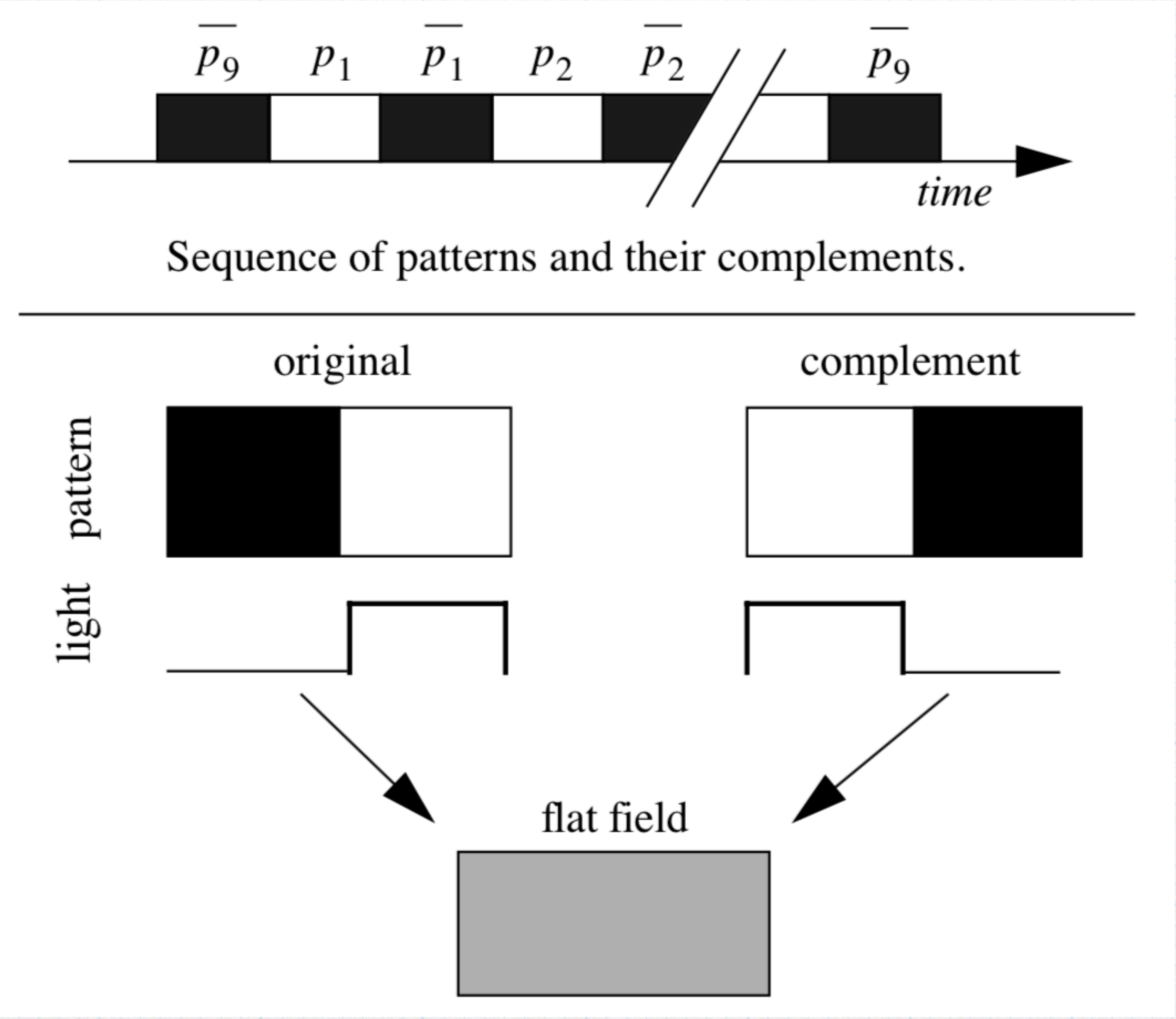
dynamic image-based modeling

* vertical bar projection
* binary images
* n-bit code for every pixel
* compute intersection
* result is model
* binary coded structured light

The office of the future,
R. Raskar et al., 1998

imperceptible structured light

* problem with structured light: flashing binary pattern
* time-division multiplexing & light cancellation techniques
    * hide patterns with light weight projections
    * projection of a flat field or white light



pattern and complement are visually integrated over time, the result is the appearance of a flat field, or "white" light.

The office of the future,
R. Raskar et al., 1998

text can only be seen with a synchronized camera

The office of the future,
R. Raskar et al., 1998

rendering and display

* images should look correct to observer
* specific algorithm
* two pass approach for rendering and displaying
  * render the 3d scene from the observers viewpoint
  * project the stored image from users viewpoint onto the polygonal model of display surface

display surface is rendered from projectors viewpoint and show the correct image

The office of the future,
R. Raskar et al., 1998

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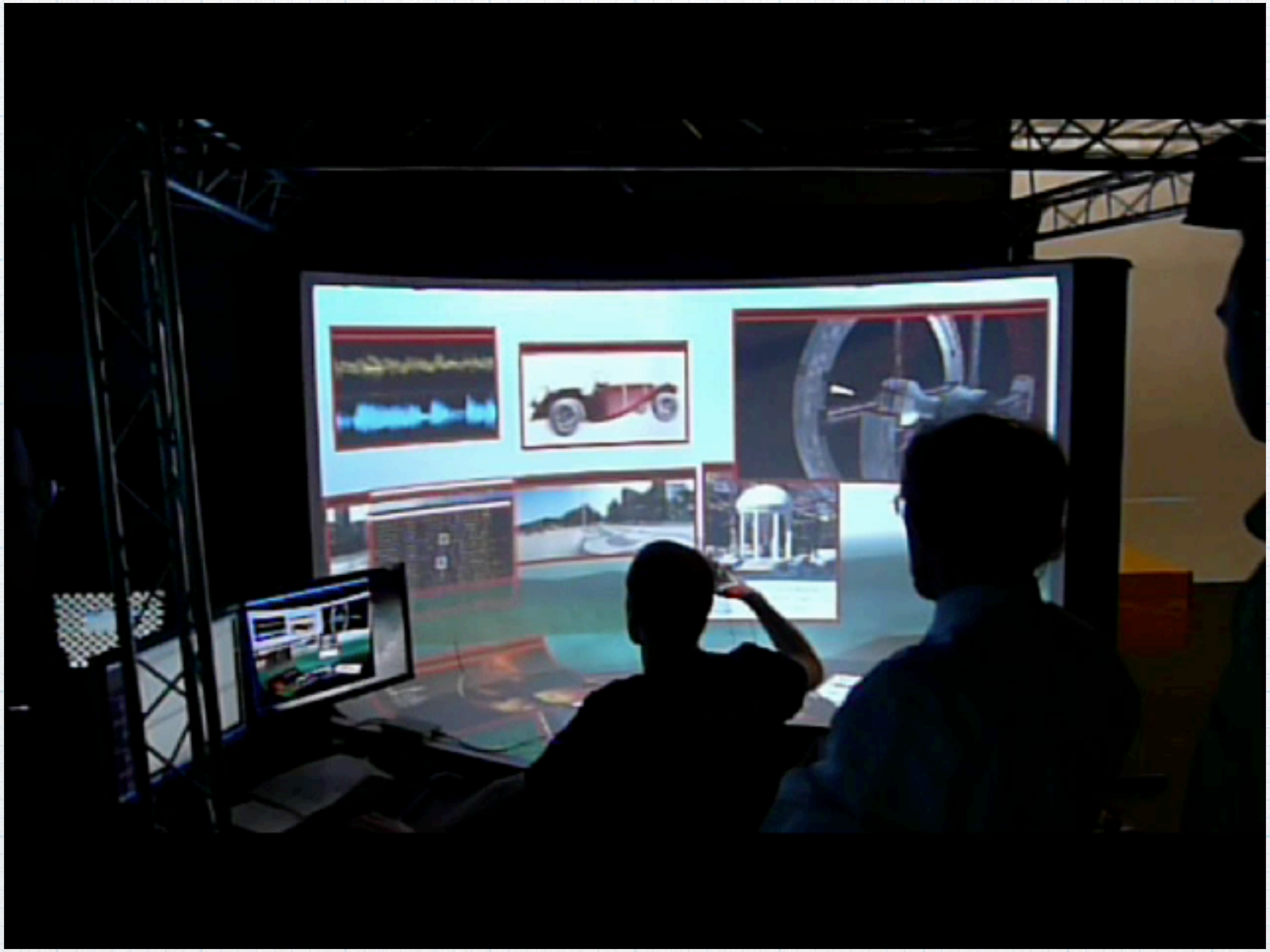
demo



challenges in group telepresence

multiple participants

* overcome irregularities on display surfaces
* projected images should appear correct
* multi user viewpoint rendering
* approach: magnetic head tracking

Immersive Group-to-Group Telepresence,
S. Beck et al., 2013

naturalness

* gesturing
* pointing
* walking
* ...

speed

* rendering display surface models
* texture mapping

latency

* synchronisation of rendering times
* frame buffer update

data handling

* large data sets
* fast networks

Immersive Group-to-Group Telepresence,
S. Beck et al., 2013

overcome challenges

solving problems to (possibly) reach target being sceptical

immersive displays

* unencumbered experience
* adapt to physical environment
* seldom need for many participants
* arise of affordable display panels

scene analysis

* combining different depth nodes
* detect continuous planar surfaces
* assigned 3d points & mathematical models

RoomAlive, B. Jones et al., 2014

user tracking

* capturing depth
* real-time physics simulation
* advanced algorithms

RoomAlive, B. Jones et al., 2014

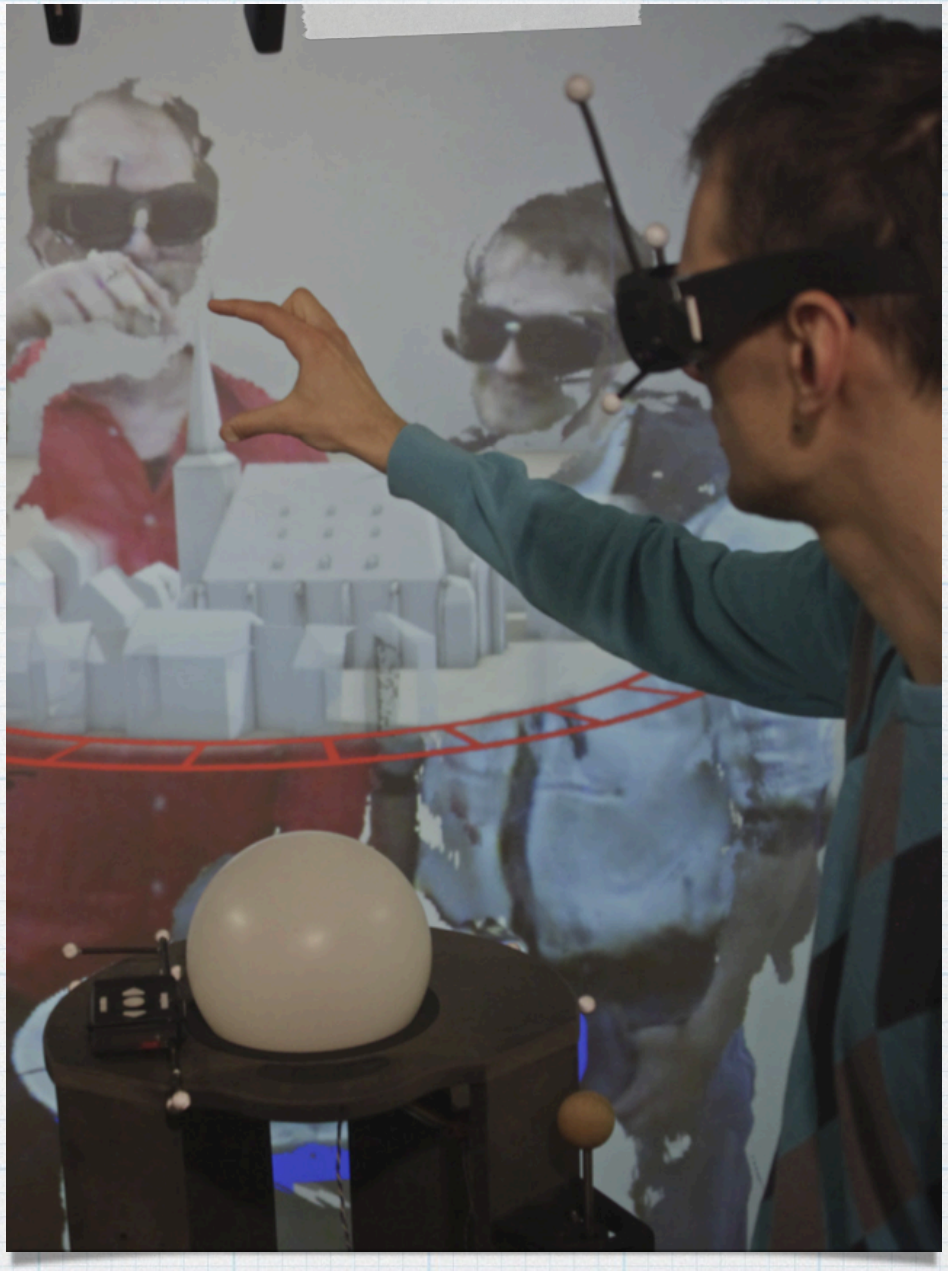
rendering

* arbitrary 3d locations
* view dependent rendering
* handle multiple users

where to use?

special use cases I

* collaboration



Immersive Group-to-Group Telepresence,
S. Beck et al., 2013

special use cases II

* gaming

RoomAlive, B. Jones et al., 2014

ideas

* digitalisation
  * physical and virtual workspace is melting together
  * gamification
* flexibility
  * high speed
  * mobile work
  * virtual communication

ideas

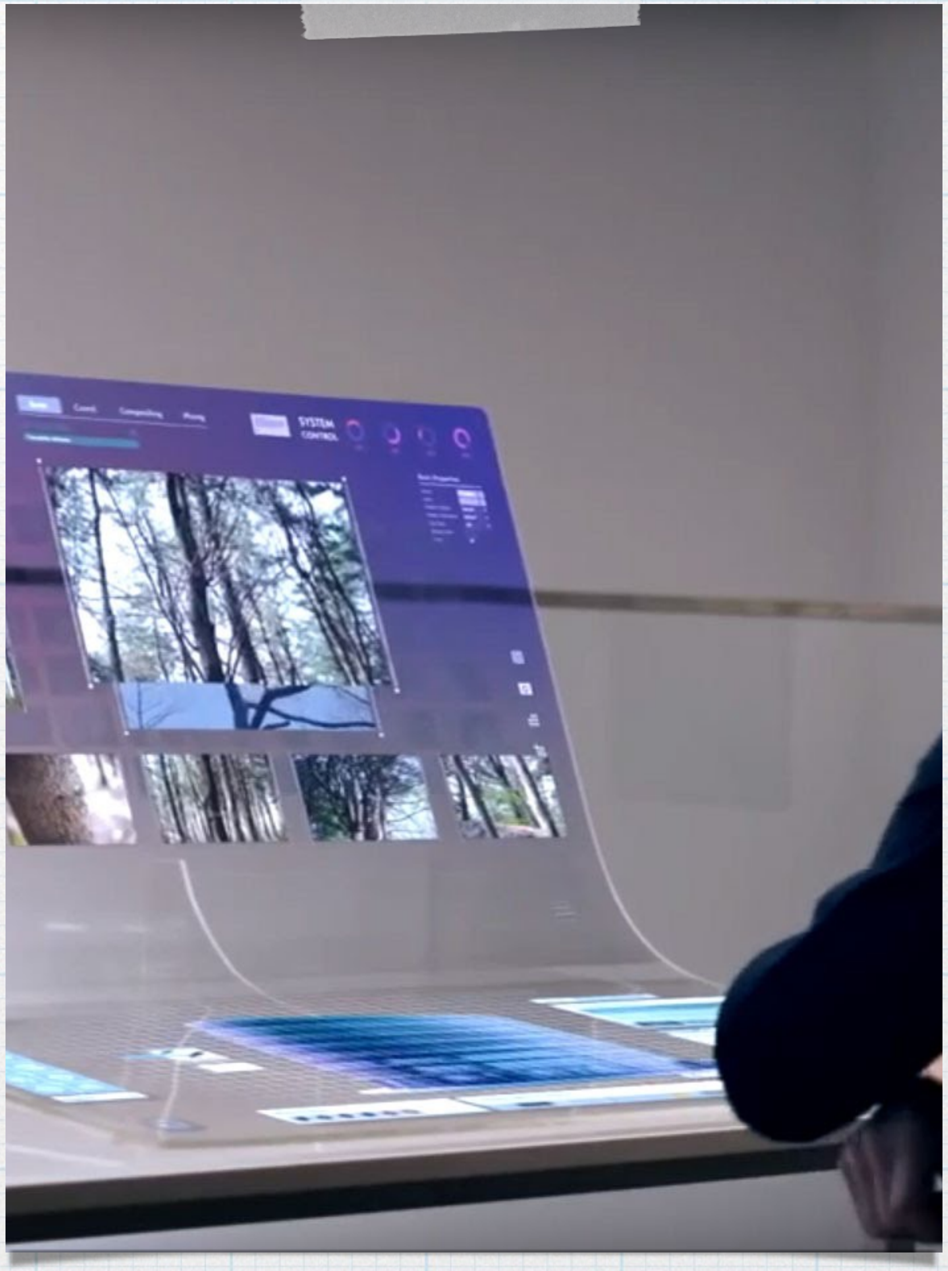
* individualisation
  * personalised workspace (physical and virtual)
* health
  * efficiency
  * behavioural ergonomics

conclusions

* supercomputer are in our pockets
* higher use of digital tools
* digital easy like gaming
* paperless

conclusions

* increased screen sizes
* supported gesturing
* VOICE
* how to fix health?



demo

https://www.youtube.com/watch?v=w-tFdreZB94

recap

* initial idea
* office of the future
* solved problems
* remaining obstacles

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thank you