Seeing Through AR (AR Longa, VR Brevis)

Steve Feiner
Columbia University
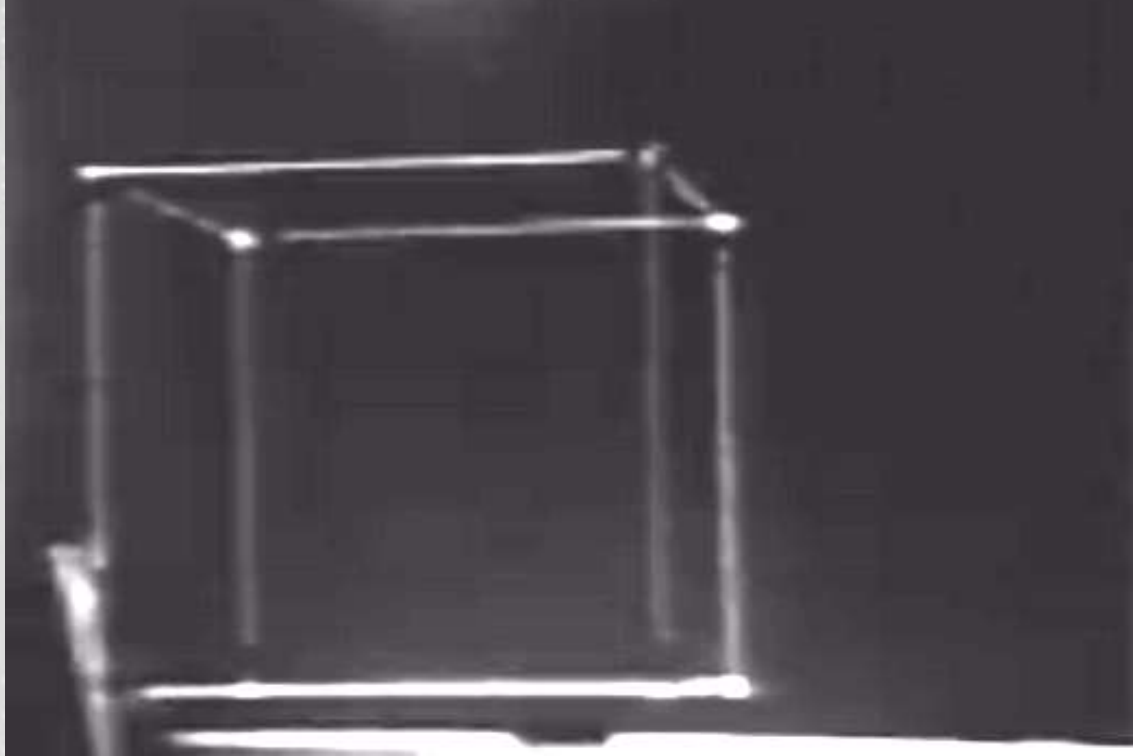
CS @CU

July 16, 2012

45 Years of AR Research

- Ivan Sutherland, Head-tracked VR/AR (Late 60s–early 70s)
  - Stereo, head-tracked, optical see-through, head-worn display
  - Graphics overlaid on real world

16 Years of Mobile AR Research

Columbia *Touring Machine* Backpack, 1996–

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Situated Visualization

S. White and S. Feiner, *CHI 2009*

Games

O. Oda and M. Sukan, 2009–

Task Assistance

S. Henderson and S. Feiner, 2009–

STEP 2: Loosen #3 Fuel Line Clamp with the screwdriver

Once clamp is loose, disconnect the #3 Combustion Chamber Fuel Line

ARMAR: AR for Maintenance and Repair

FUEL LINE 3
CLAMP
SCREW

S. Henderson and S. Feiner, *ISMAR 2009*

ARMAR: Workpiece Task Assistance Study

- Is AR better than conventional (computer) documentation?
  - Assemble aircraft engine combustion chamber
  - Select bottom and top, align correctly, pin

ARMAR: Workpiece Task Assistance Study

- Within-subject
- Counterbalanced start condition: AR, LCD
- Randomized chamber bottom/top, pairs of holes
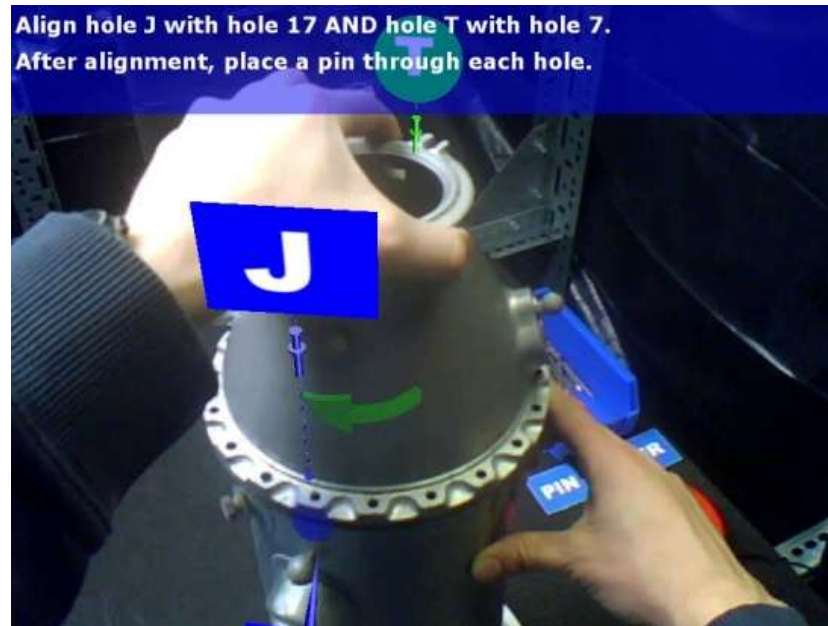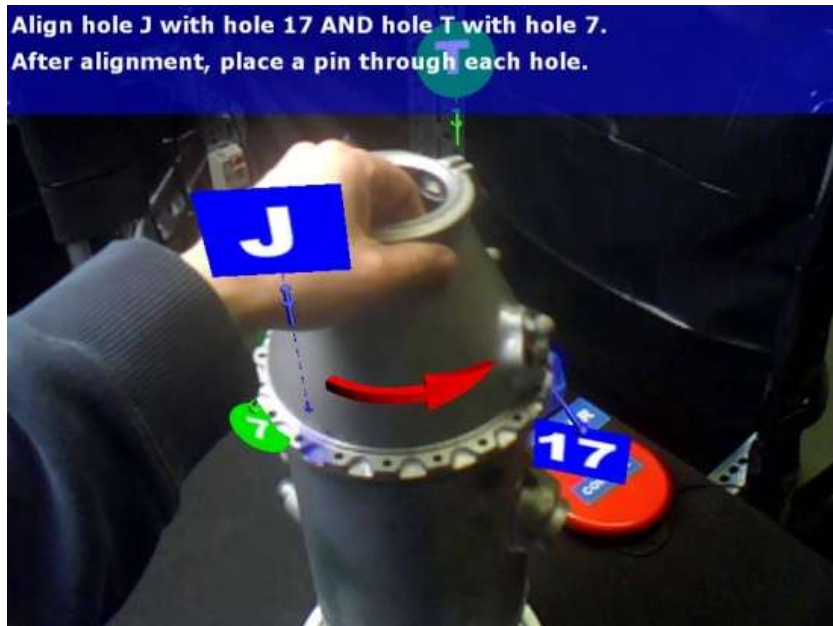

AR Condition

LCD Condition

ARMAR: Workpiece Task Assistance Study

- Source/destination bin highlights
- Motion paths

ARMAR: Workpiece Task Assistance Study
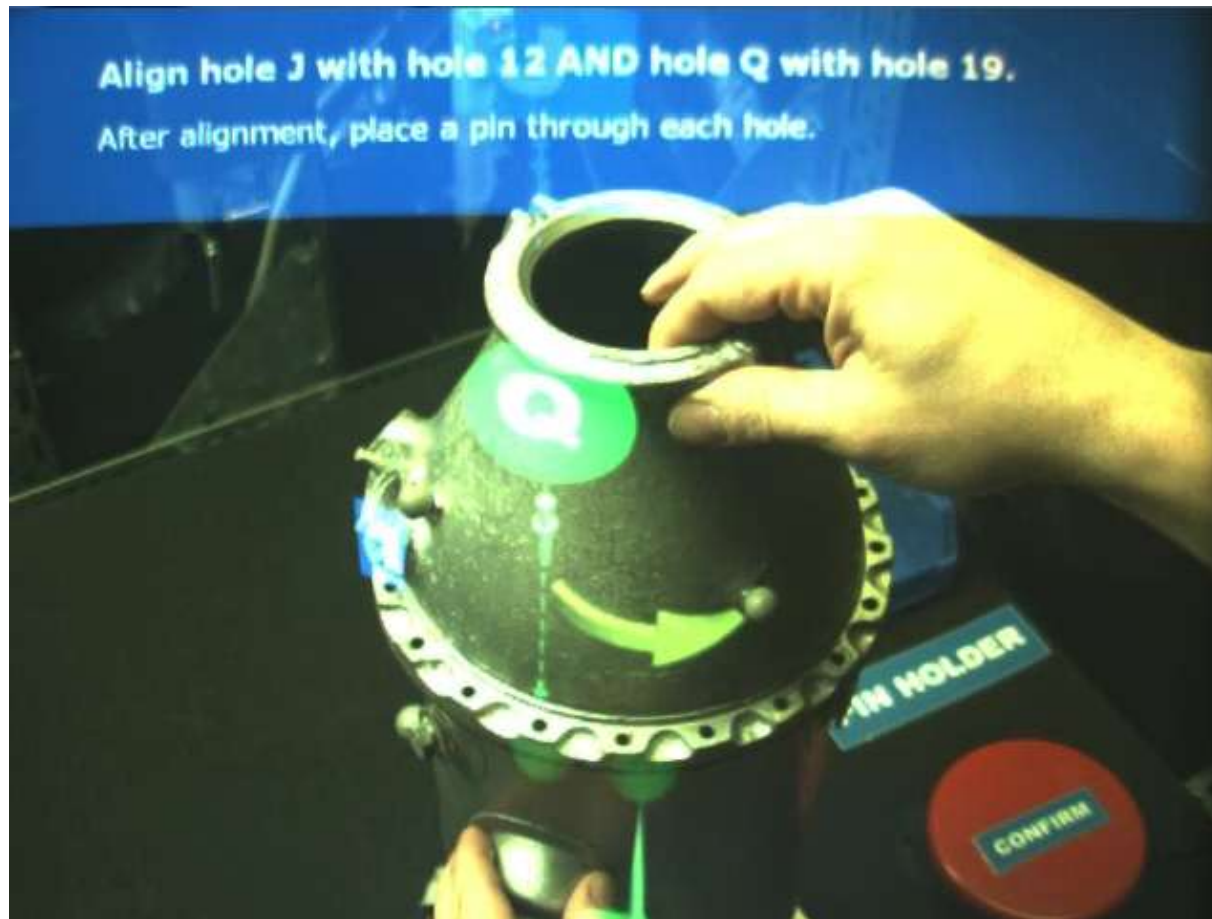
- Prescriptive 3D arrows
- Billboarded labels

- Alignment highlights

ARMAR: Workpiece Task Assistance Study

ARMAR: Workpiece Task Assistance Study

- Results of 22-participant formal study (α = .05):
  - H1: AR faster for alignment/pinning (24.2s vs. 45.5s)
  - H2: AR more accurate [aligned within .5 hole width] (95% vs. 62%)
  - H3: AR preferred [ranked higher in questionnaire] (20 of 22)
  - H4: AR more intuitive [ranked higher in questionnaire] (19 of 22)

Research Directions

Overcoming the Handheld Lifestyle

"Excuse me while I pull out my phone, turn it on, wait for it to start tracking, hold it at arm's length,…"

Eyewear

Not This...

NVIS

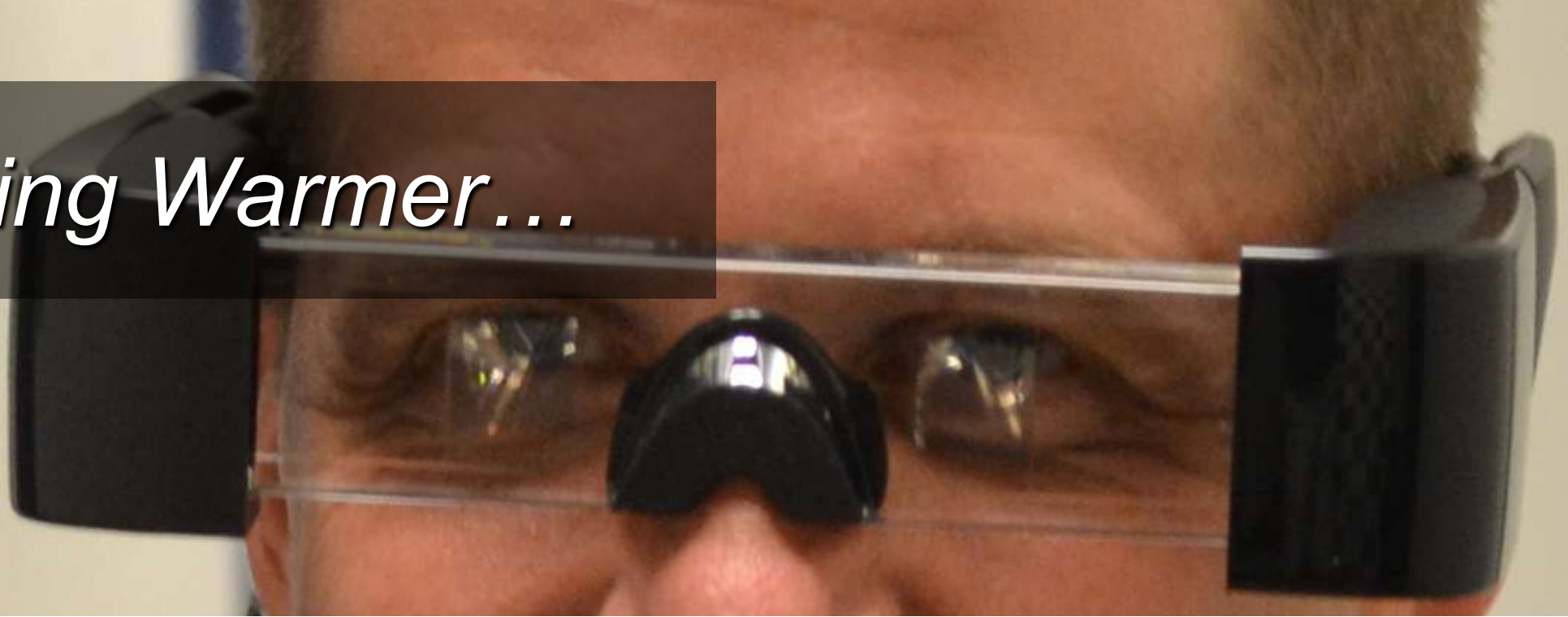*Or This…*

Google Glass prototype, 2012

MicroOptical Corp. clip-on, late 20th C.
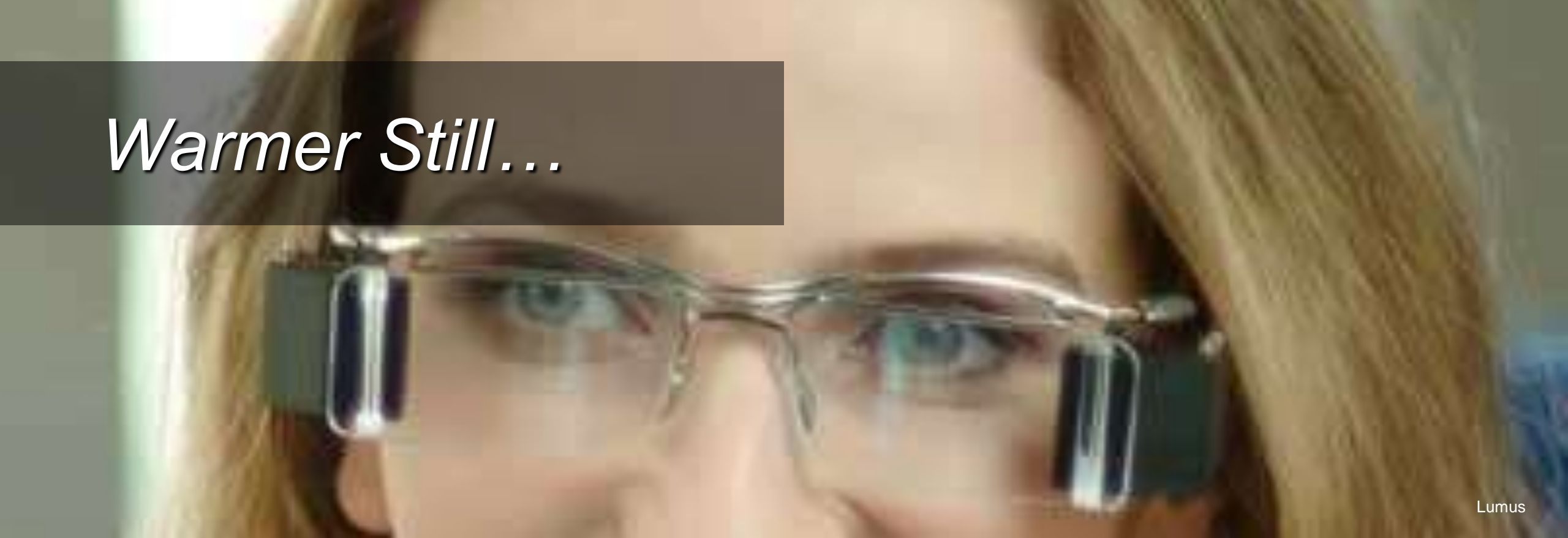
IBM Visionpad,, late 20th C.

Getting Warmer…
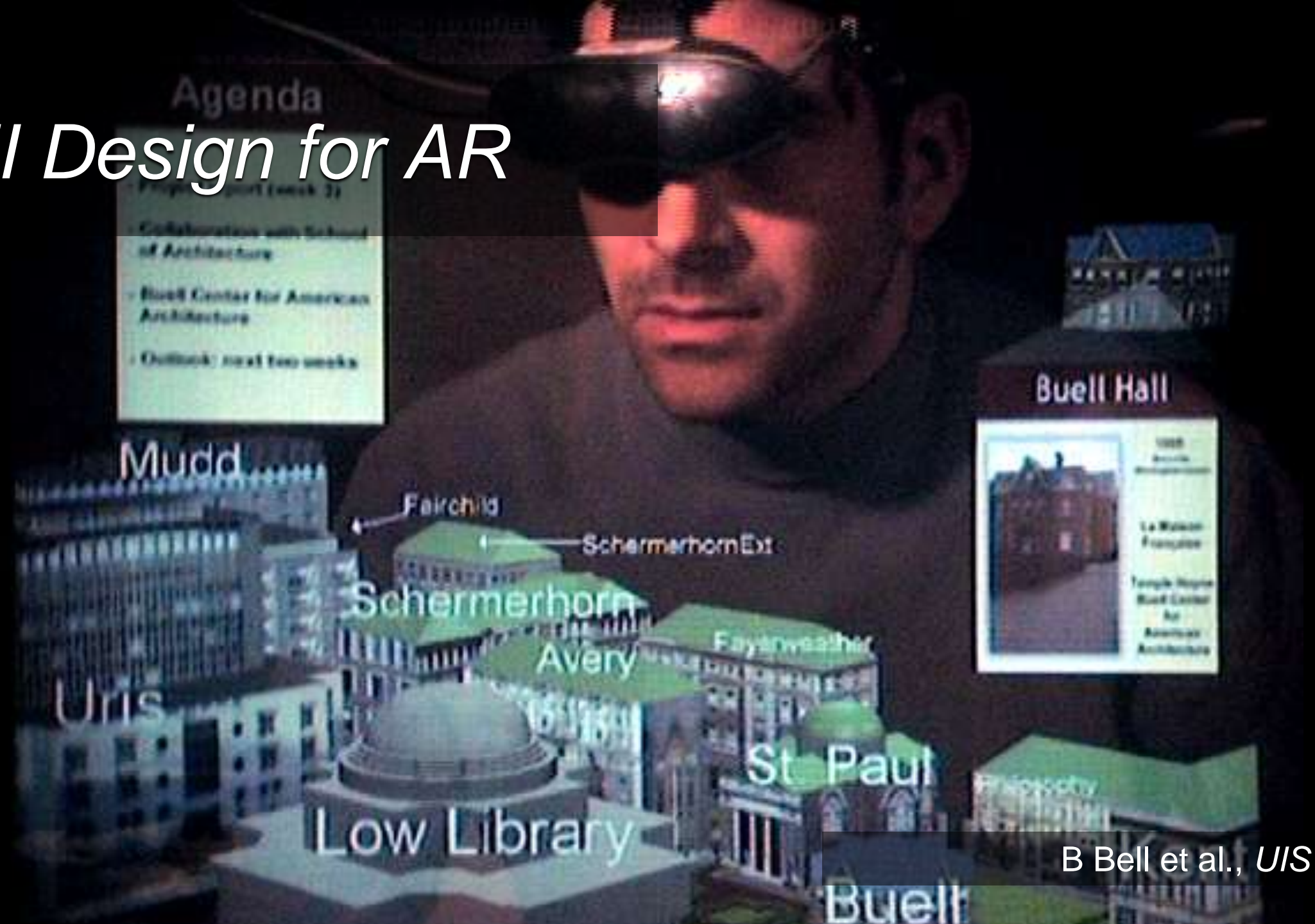
Epson

Vuzix

Warmer Still…

Lumus

Sony

Combining Eyewear with Other Displays

UI Design for AR

B Bell et al., *UIST 2001*

Education
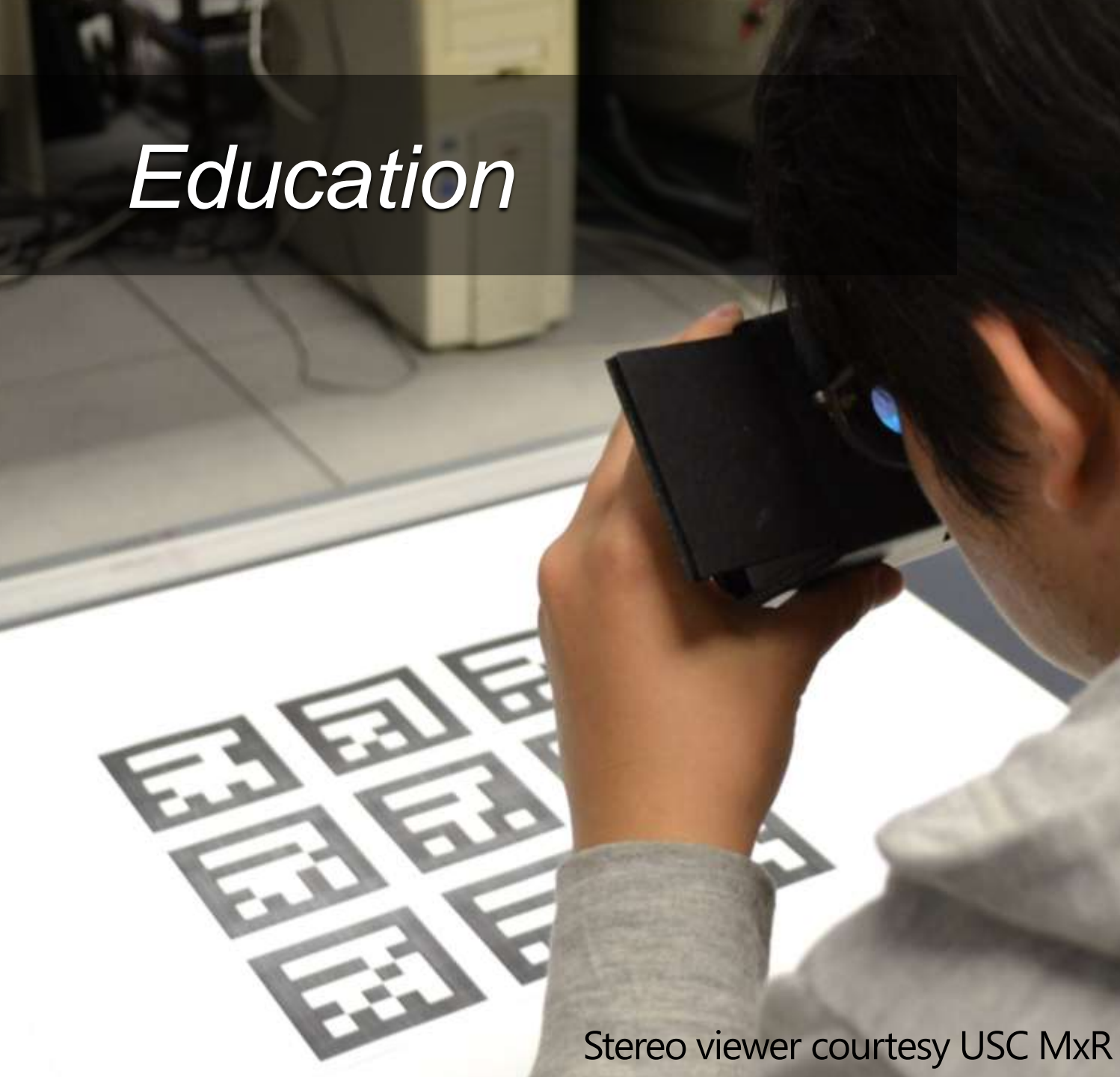
E. Arreguin, C. Galvez,
S-H Tsai, L. Yang

Stereo viewer courtesy USC MxR

Privacy

- In the face of massive public deployments of wearable sensors, what are the consequences of streaming, searching, matching, and storing multimedia data that is
  - time-stamped
  - georeferenced

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