Microsoft

Microsoft Research

# Faculty Summit 2012

ADVANCING THE STATE OF THE ART

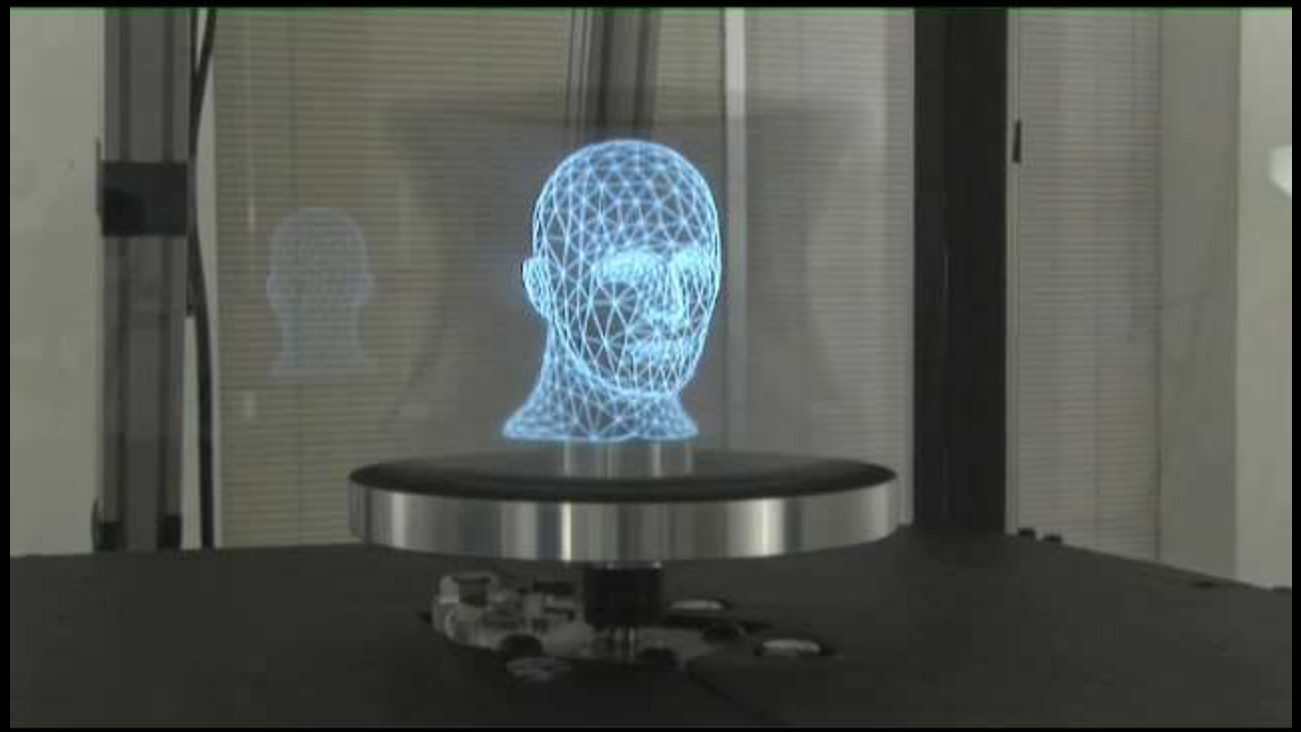
# Augmented What?

Mark Bolas, Evan Suma
Institute for Creative Technology
USC, School of Cinematic Arts
(Fakespace Labs)

July 1012

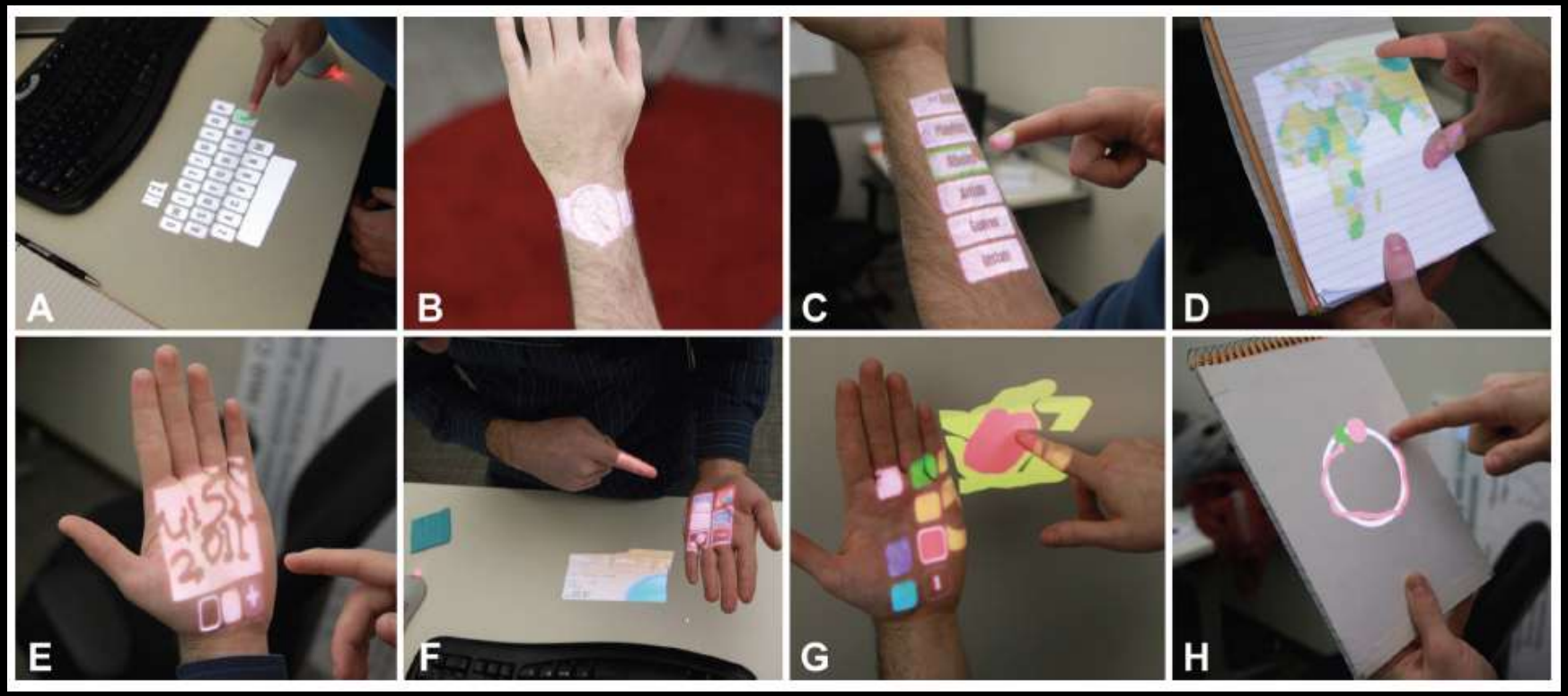
# Huh?

# NO! Reality is Volumetric



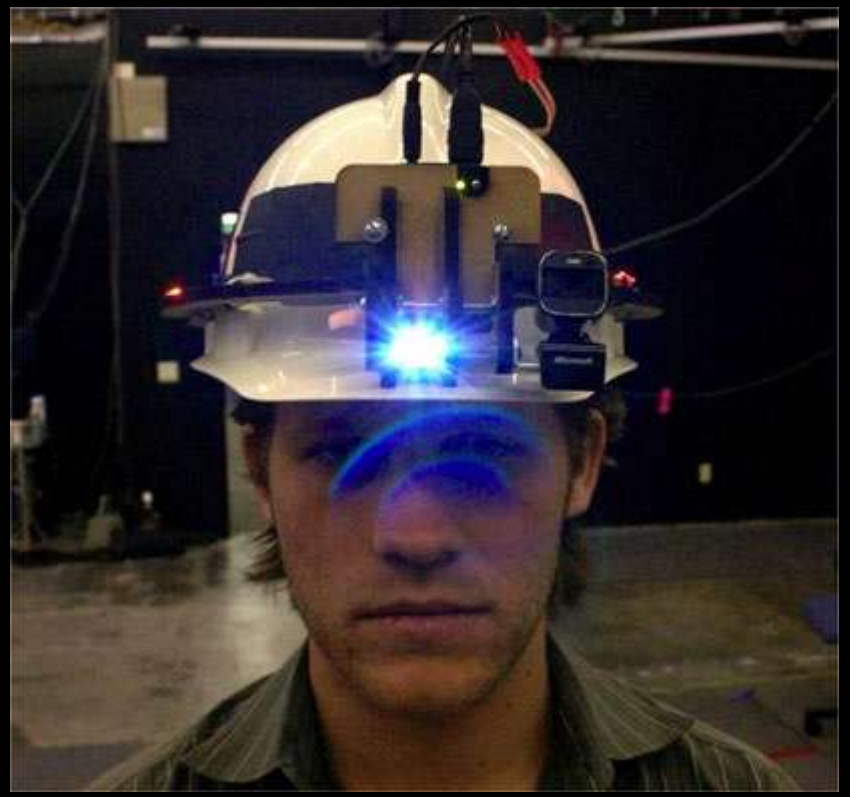
**Rendering for an Interactive 360º Light Field Display,**
A. Jones, I. McDowall, Yamada H., M. Bolas, P. Debevec Siggraph, 2007

# AR is a Substance to Put Into the World




Harrison, Benko, Wilson, *Omnitouch,* UIST 2011, Microsoft Research and CMU

# Not Looking Through Glass



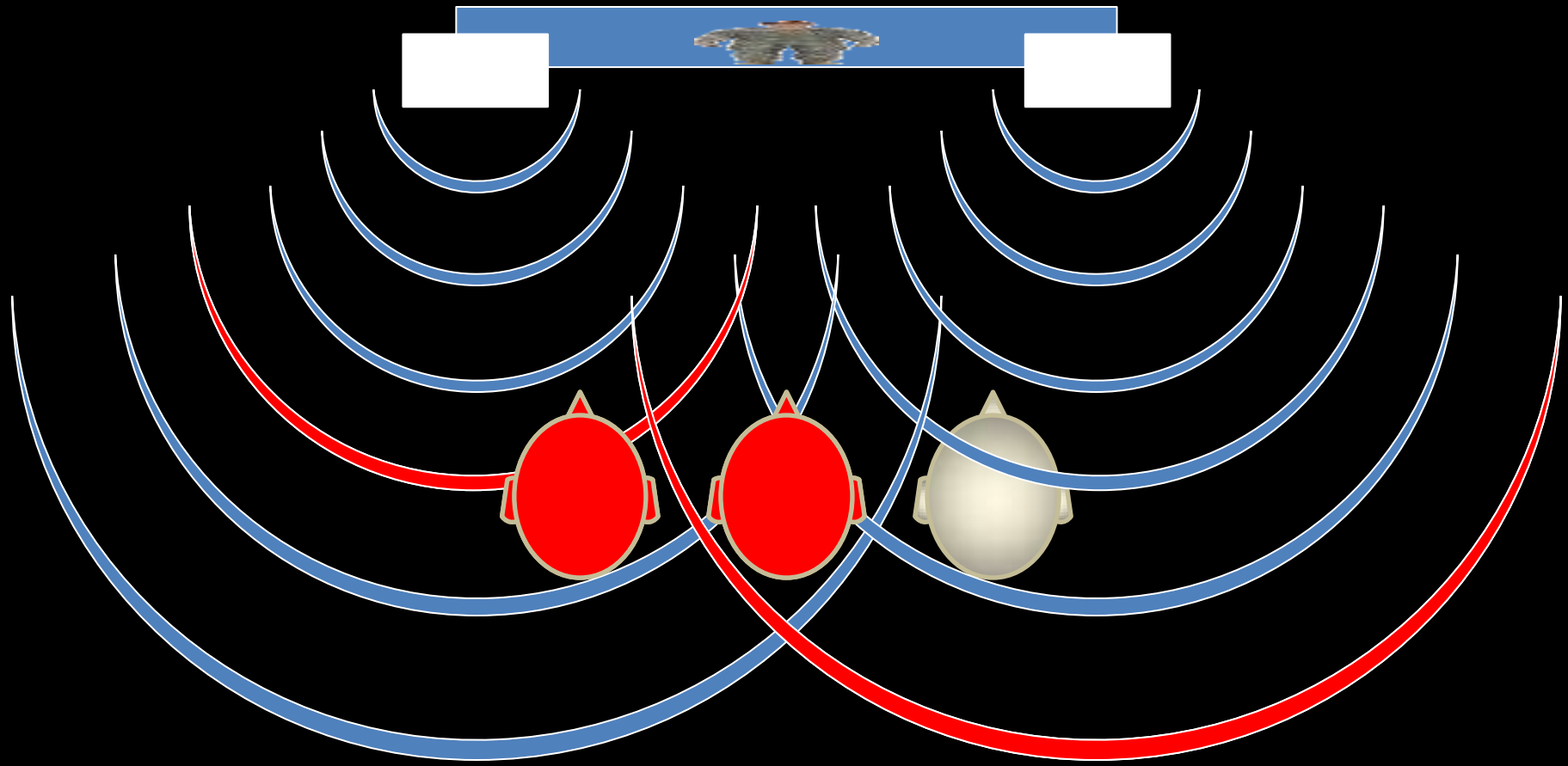
Augmented Reality Using Personal Projection and Retroreflection
David M. Krum, Evan Suma, Mark Bolas, Personal and Ubiquitous Computing, 2011

# Inlays Can Look You In The Eye

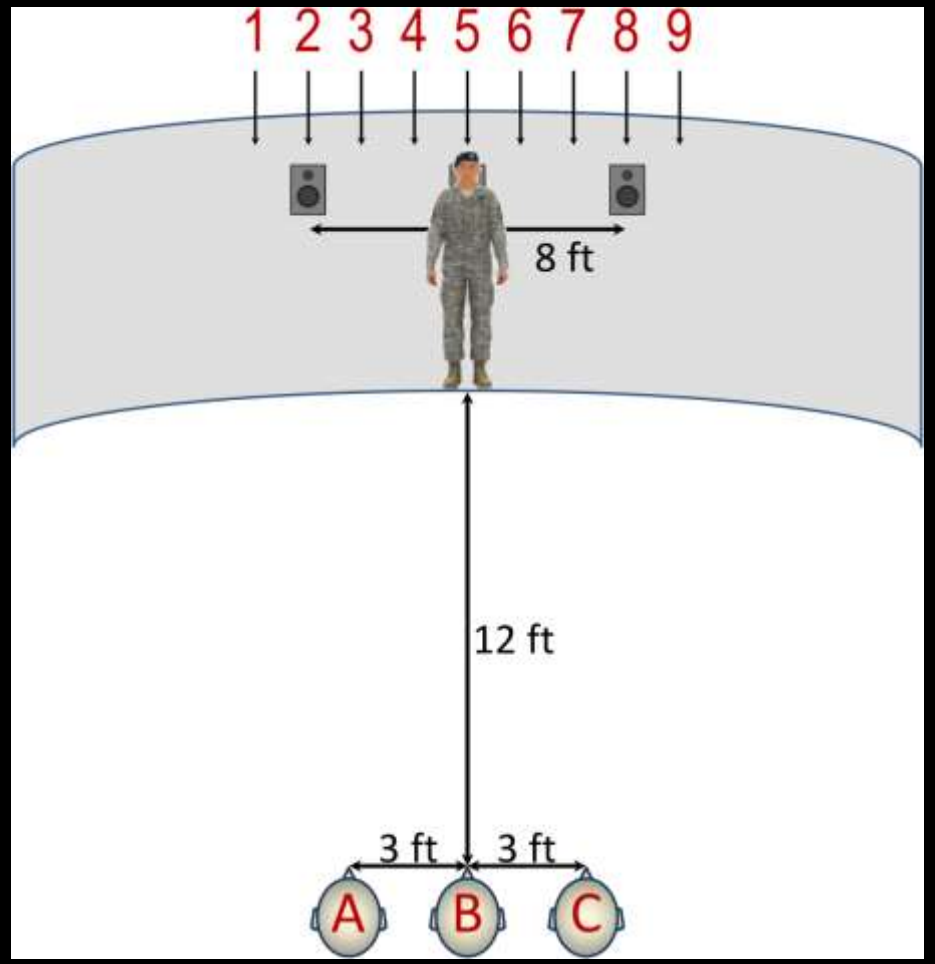
# Inlays Everywhere

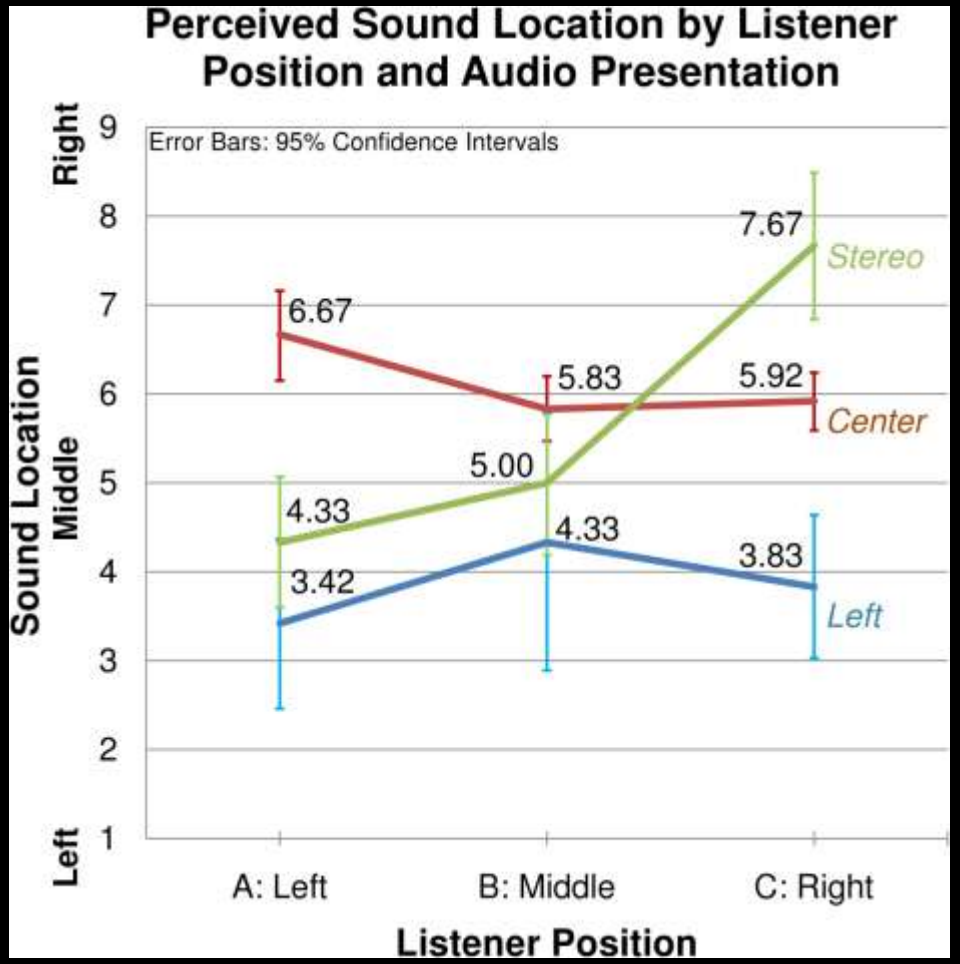
# Sound is Volumetric Too

# Pointsources -> Waves fields



# Humans Hardwired for Wavefields



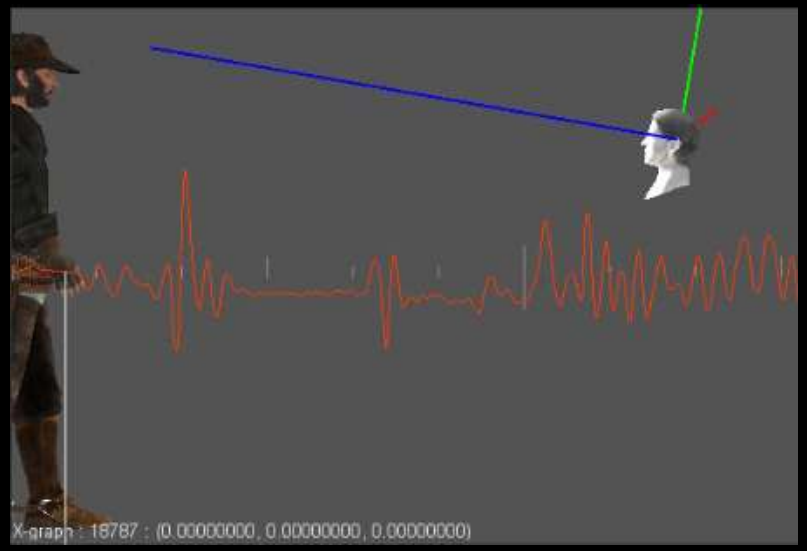

Krum, Suma, Bolas, 2012

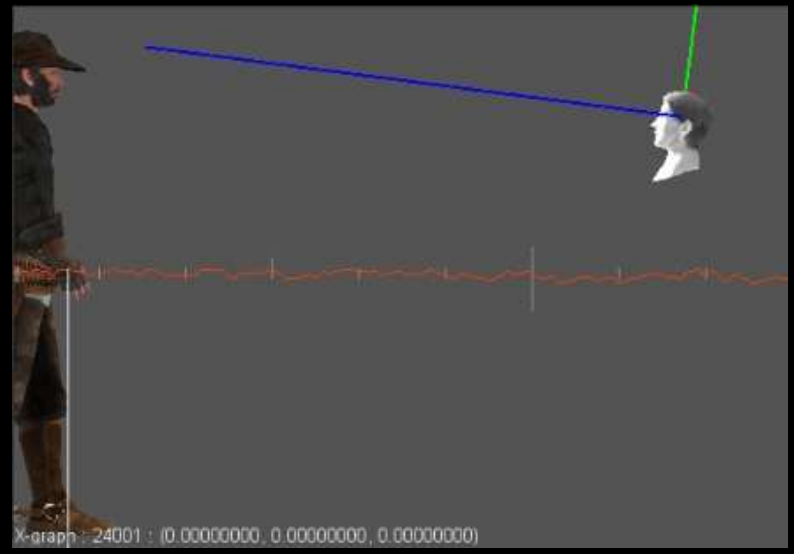
# Wavefields + Realty = Little Reflection

**Achieving eye contact in a one-to-many 3D video teleconferencing system,**
A. Jones, M. Lang, G. Fyffe, X. Yu, J. Busch, I. McDowall, M. Bolas, P. Debevec

# Reality is Framed

# Frames Can Hurt



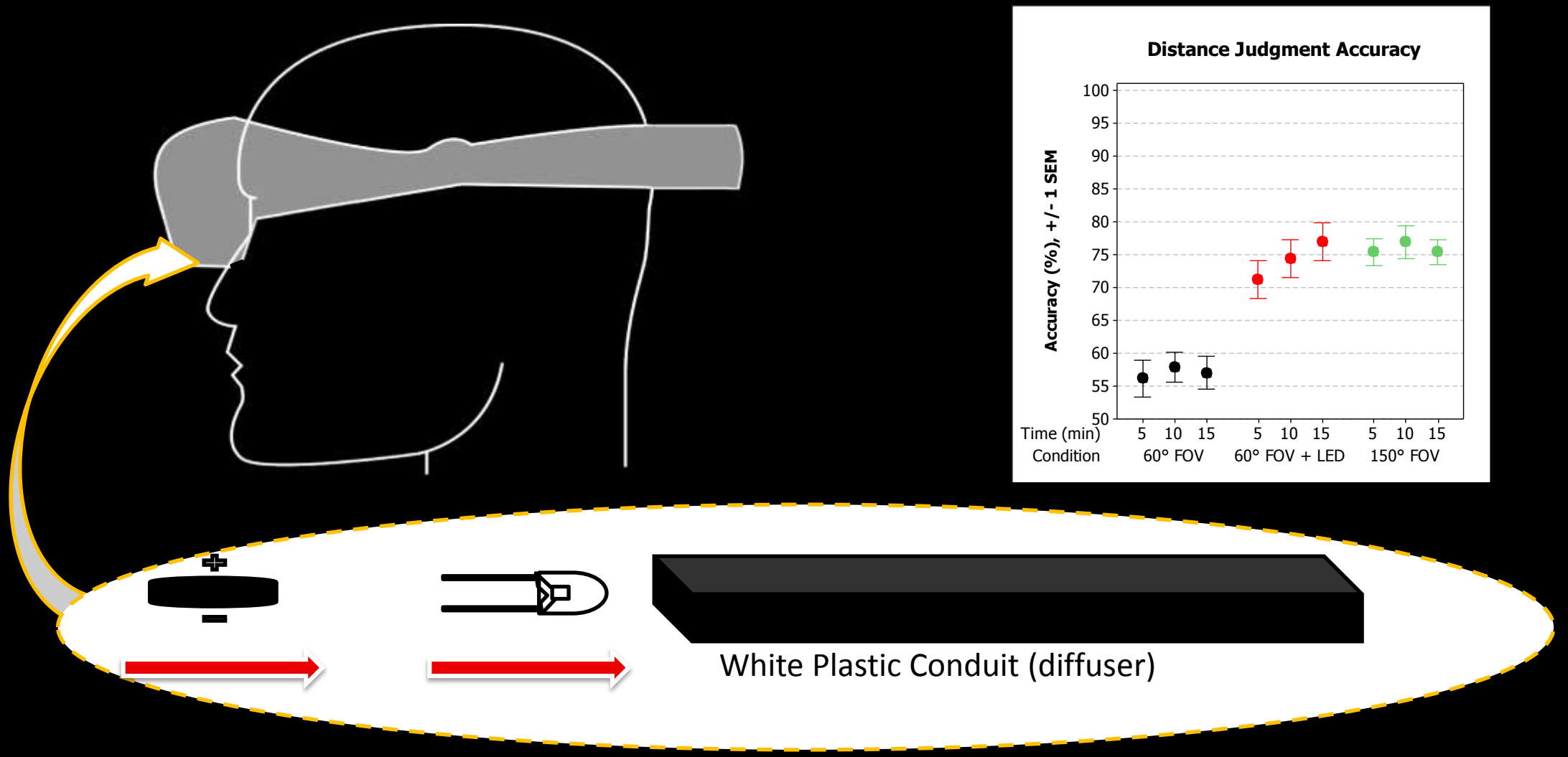
# Frames Can Help


Cao, Bolas, E-Tech Submission 2008

# Embrace the Frame


Paparazzi, Qualcomm AR Challenge Winner,

# Stretch the Frame



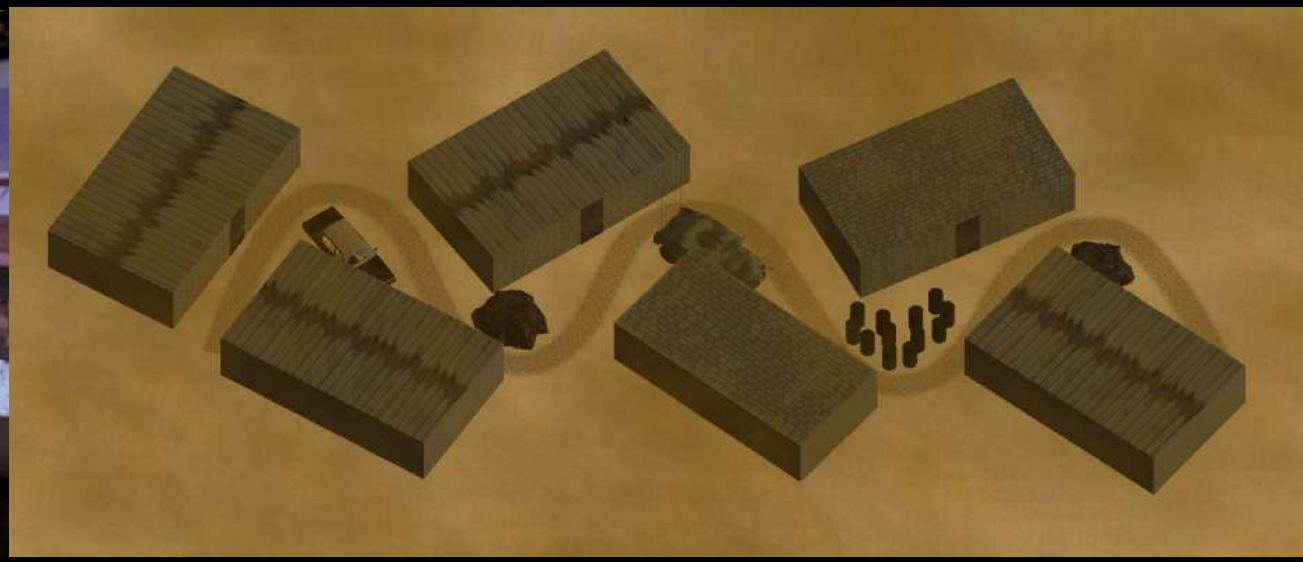




A. Jones, E. Swan, S. Ellis, M. Bolas

# Reality is Malleable

# Stretching Space



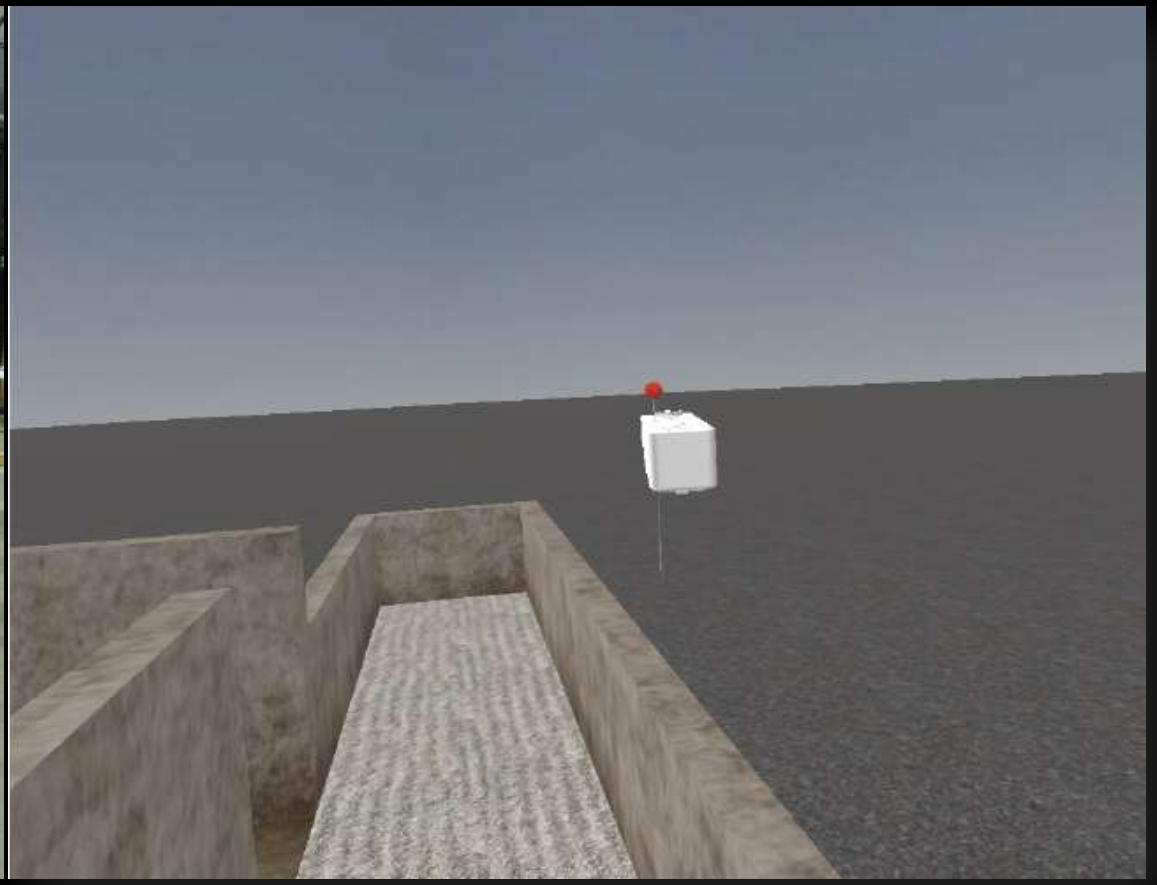
*Impossible Spaces,* Suma, Lipps, Finkelstein, Krum, Bolas, IEEE VR 2012


Z
Persp
Camera Preview

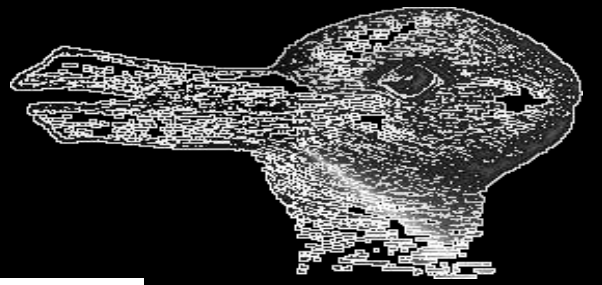
# Translates to Augmented

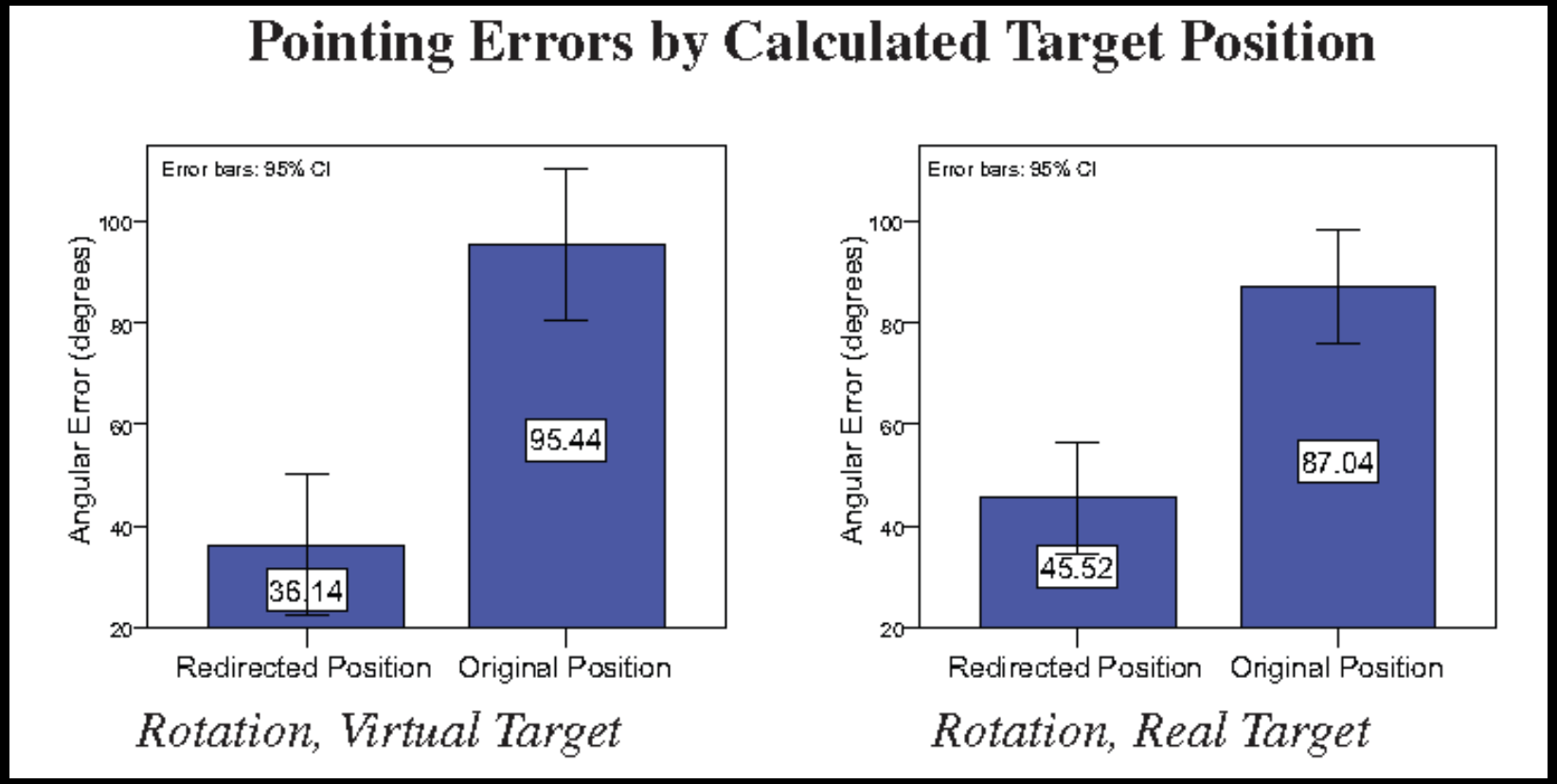
Inspired by: L. Kohli, *Redirected Touching: Warping Space to Remap Passive Haptics*, UNC EVE group, 3DUI 2010

# Does the Real World Get Warped?



# Reality Comes in Second

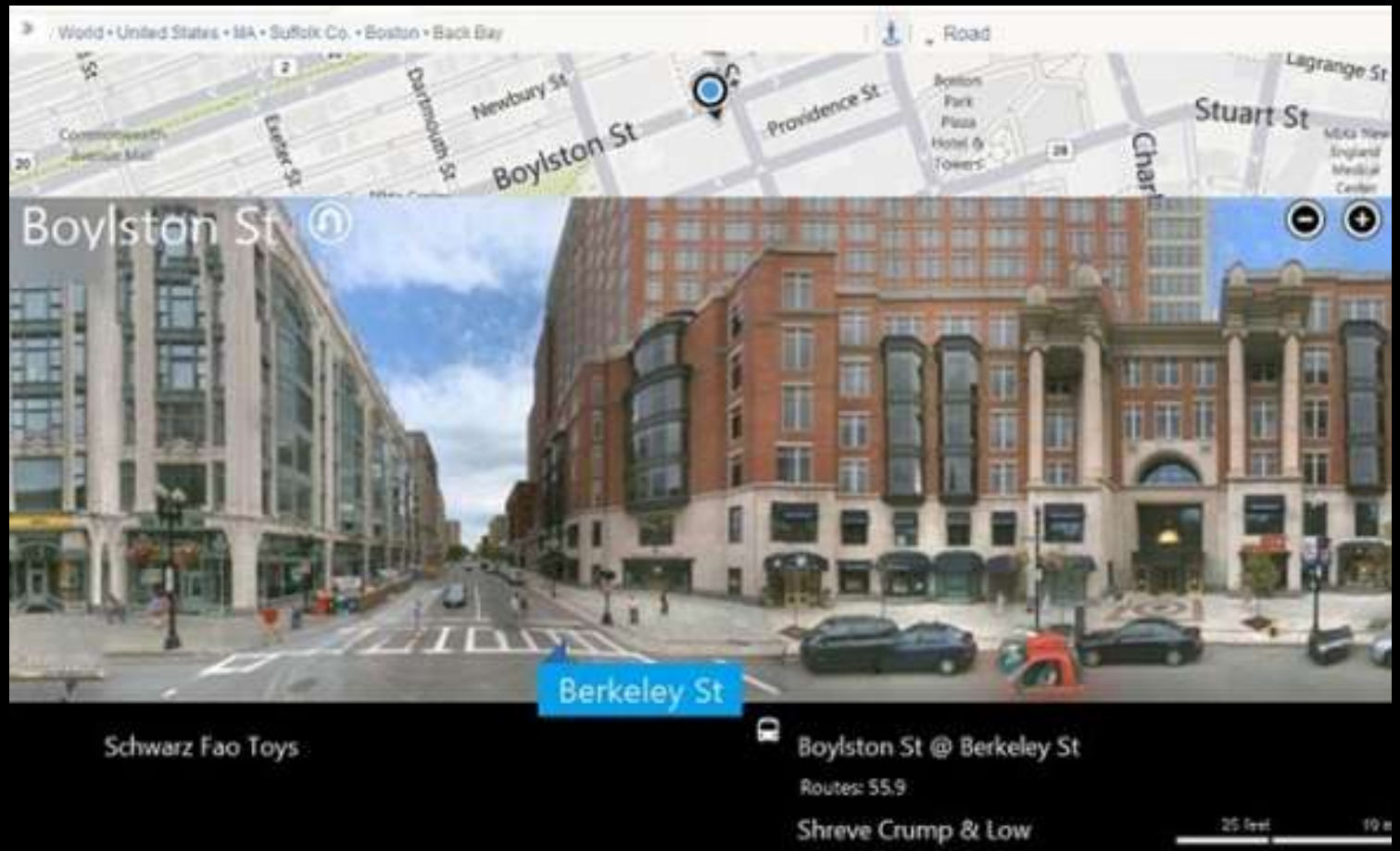





Effects of Redirection on Spatial Orientation in Real and Virtual Environments,
Evan Suma, David M. Krum, Samantha Finklestein, Mark Bolas,
IEEE Symposium on 3D User Interfaces, 2011

# Reality is Toast

# Augmentation is Weaved
# Into the Fabric of Modern Reality



# We Anticipate The Virtual


Bing’s Streetside View

# We Tune Away the Real

# We Function Better with the Virtual

CNET › News › Crave

## IT in the Toilet: Study shows cell phones big in bathroom

We've had our suspicions, but now we know. A study from 11mark found that 75 percent of American mobile phone users use their phones in the bathroom to make calls, text, and play with apps.

# We Won’t Touch the Real

# We Prefer the Virtual

## iPod Generation Prefers MP3 Fidelity, Study Says

By Nick Spence, macworld.co.uk Mar 5, 2009 4:31 pm

A prolonged study suggests that iPods and MP3 players have affected how people, the young especially, respond to music's fidelity range.

Jonathan Berger, Professor of Music at Stanford University, California, has conducted an eight-year study in which students have rated various audio formats while listening to the same song.

# REALITY

Worst game ever.

# Pushing Pixels Out -> Pulling Reality In

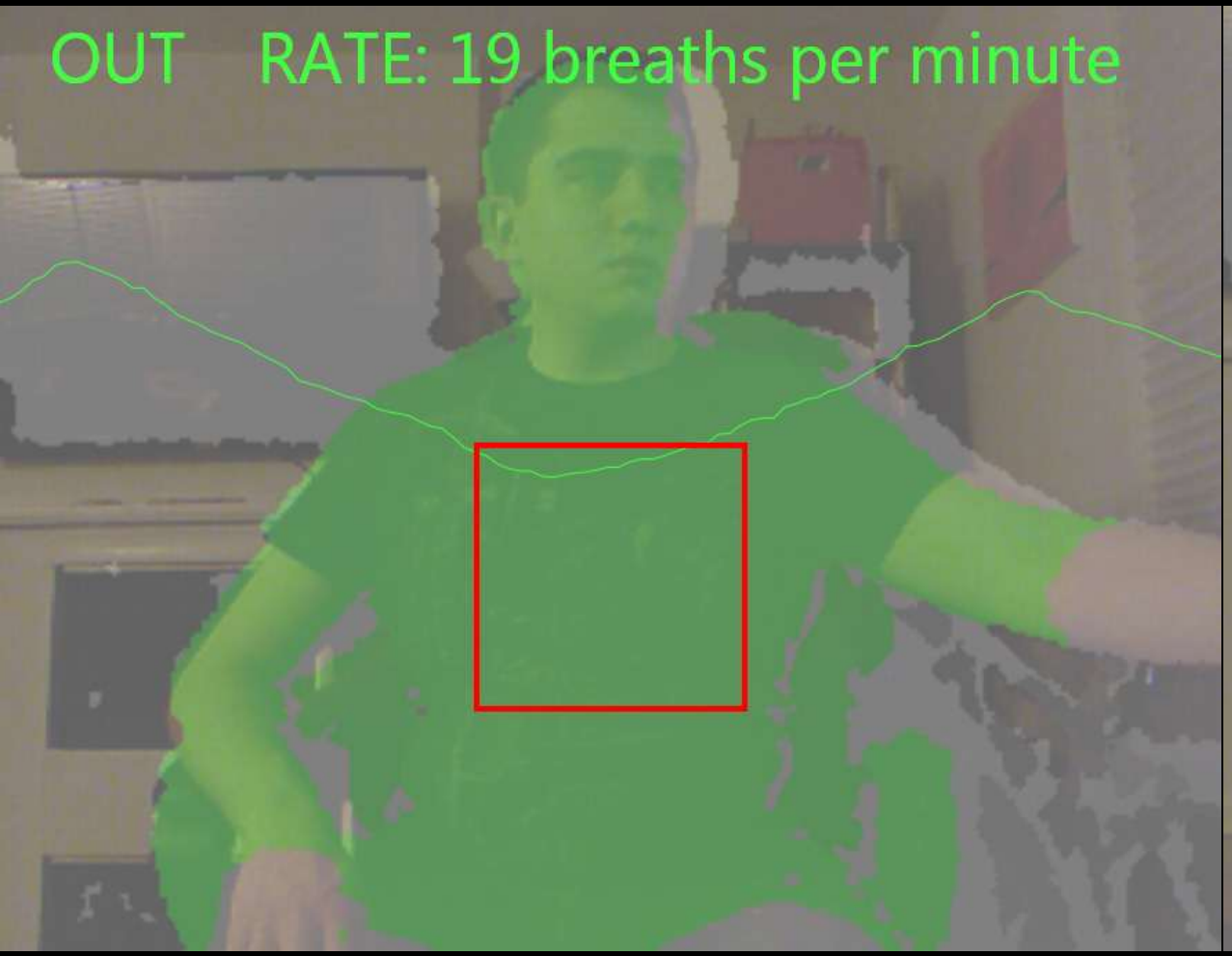
Treating Virtual Information as a Substance to Inlay into the World

Realizing that ‘the World’ is a Framed and Malleable Construct the User Creates

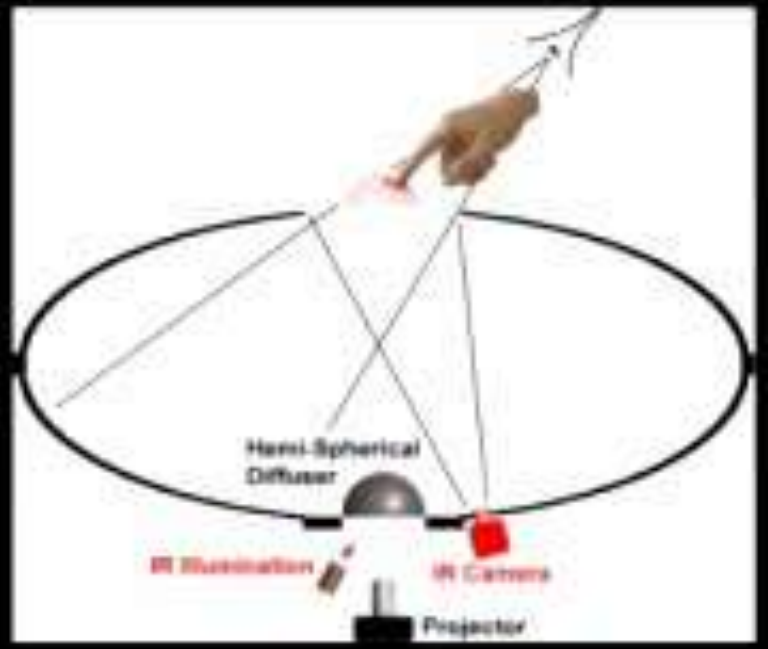
Pulling Information from the Real World to Put It into the Virtual

Augmented Reality is the Last Bastion of Reality

# Pull-In Body Language




# Sense and Leverage Dexterity




**Illuminating the bottom hemi-spherical diffuser with IR light creates an invisible "floating" IR 3D sphere above the aperture**

Butler, et al., Microsoft Research, UIST 2011

# Engaging Place with Virtual


Stein, Fisher, *Million Story Building*, SCA Interactive Media, 2011

# What Are The Affordances Of Reality
# or
# My Phone Does Everything I Need

People

- Read Expressions, Stress, Intent, Desire

Places

- Memories in Places, Situational Context

Things

- Tangible, Links to Knowledge

Ideas

- Blogs, Wikis, Ted Talks, KickStarter Projects

# Reality is Mobile

Los Angeles Times

$1.00 DESIGNATED AREAS HIGHER 80 PAGES © 2011 LAT FRIDAY, OCTOBER 14, 2011 latimes.com

PAST AND PRESENT: The Museum of London's Streetmuseum app shows Piccadilly Circus, a busy plaza in the heart of London, in 1953 and 2010.

# Putting 'real' in virtual reality

Technology that augments what can be seen in plain sight with photos, videos or text is booming.

SHAN LI

You point your smartphone at an Italian restaurant, and diner reviews of its lasagna pop up on-screen.

Or you aim your tablet computer's camera down a residential street, and over images of the houses you see which ones are for sale — along with the asking price, number of baths and square footage.

Haven't done this yet? You probably will soon.

The technology is called augmented reality, or AR, and businesses are racing to incorporate it in as many consumer applications as they can. It's essentially the same technology TV sportscasts use to digitally paint a first-down line on a football field, adapted and updated for camera-equipped smartphones and tablet computers.

"In the future, you'll be able to point your device at anything around you and, without prompting, that device will recognize what is there, incorporate your interests, and layer on information about what you're looking at," said Brian Blau, research director at Gartner Inc. "Point a phone at a building, you'll see the history, for example. Or at a flower, the kind of flower

[See AR, A12]

October 14, 2011

The New York Times

MONDAY, APRIL 10, 1989



# What Is Artificial Reality? Wear a Computer and See

By ANDREW POLLACK

Special to The New York Times

MOUNTAIN VIEW, Calif. — Architects now design buildings on paper or computer screens. But some computer scientists envision that architects will one day be able to simulate walking through a building, grabbing and repositioning columns and doors with simple movements of the hand.

Such a vision might sound far-fetched, but computer scientists are already at work on systems that would allow people to interact with computers in profoundly new ways. Wearing a special helmet and gloves, people would feel immersed in three-dimensional computer-generated worlds and could control the computer by using their hands in a natural manner.

Two people might one day play simulated tennis with each other without leaving their living room. And because simulations need not be limited to what can occur in real life, a chemistry student might experience life as a molecule mingling with other molecules.

## Years Away From Reality

Such advanced simulation systems are being called artificial realities, virtual realities or virtual environments. The word virtual is used in the computer industry to refer to what appears to be present but is not.

Useful artificial reality systems are still years from, well, reality.

The helmet-and-glove systems, for example, can cost as much as $300,000, and technological hurdles remain. Despite these obstacles, however, pieces of the technology are starting to be applied in education, game playing, medicine, robotics and avionics.

"The virtual environment gives you the opportunity to actually feel present, and I think that's a compelling illusion," said Michael W. McGreevy, a research scientist at the National Aeronautics and Space Administration's Ames Research Center here.

## 'New Level of Reality'

Jaron Lanier, founder and chief executive of VPL Research, a company in Redwood City, Calif., that makes gloves and other "computerized clothing" for use in virtual environments, sees a day when the new systems will be far more important than mere computers or even television.

"It's a new level of reality," said Mr. Lanier, a 28-year-old programmer who has become a guru of the artificial reality movement. "There's never been another one except for the physical world, unless you believe in psychic phenomena."

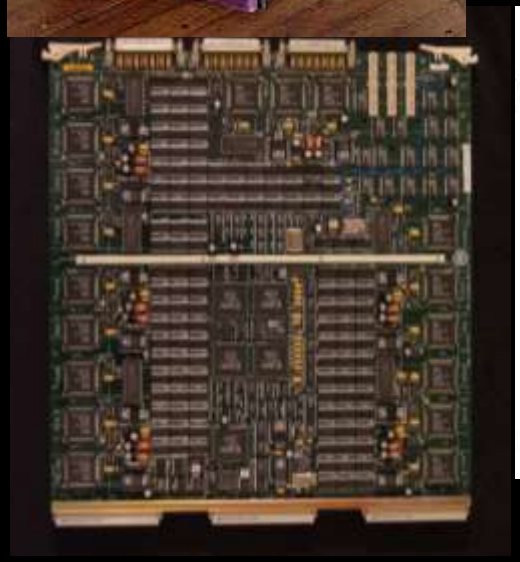
A system developed at NASA

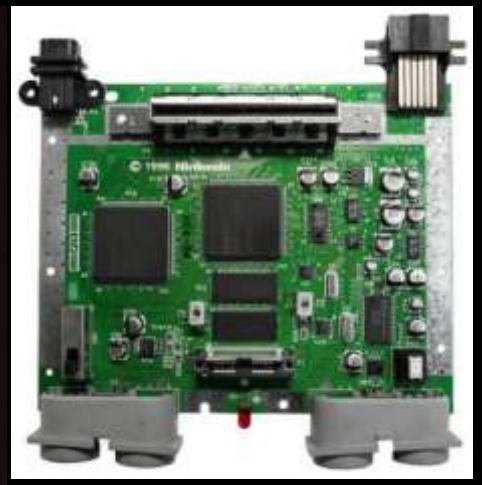
Continued on Page C7, Column 4

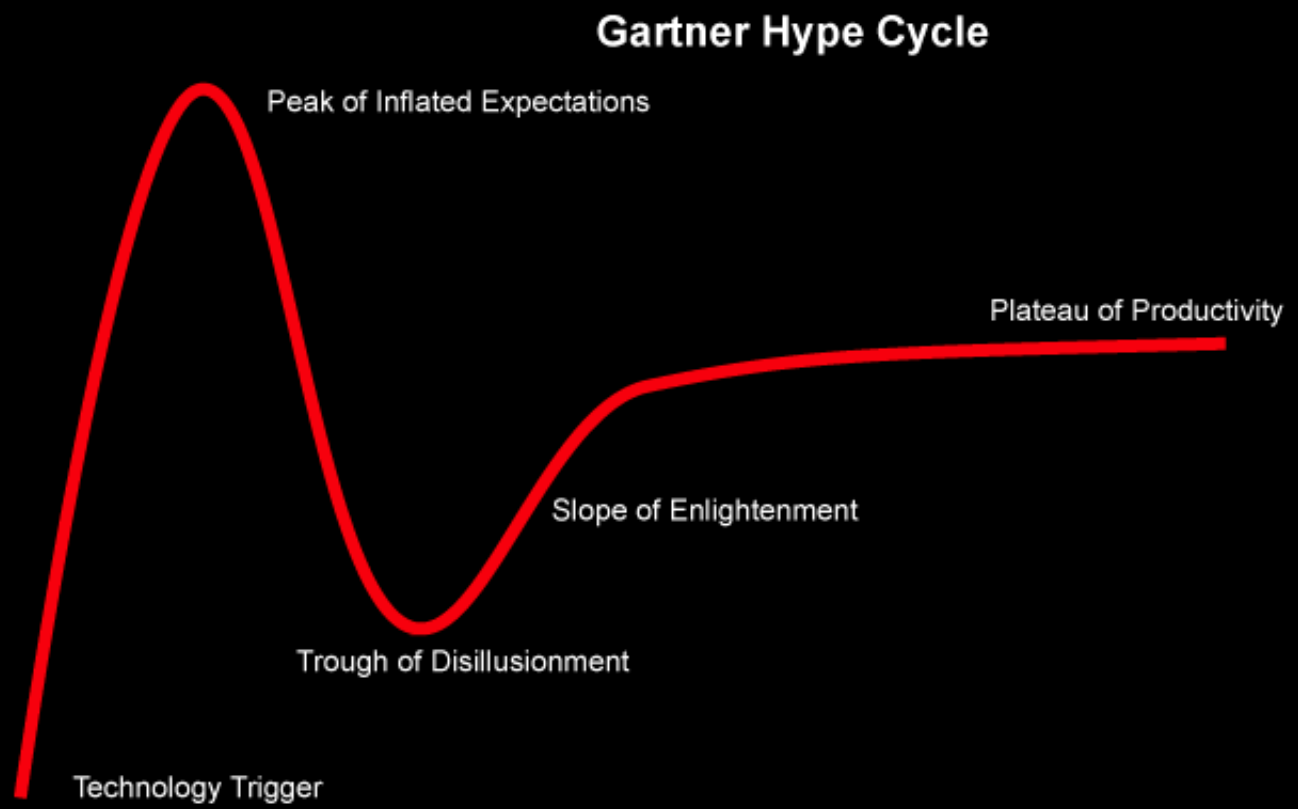
April 10, 1989

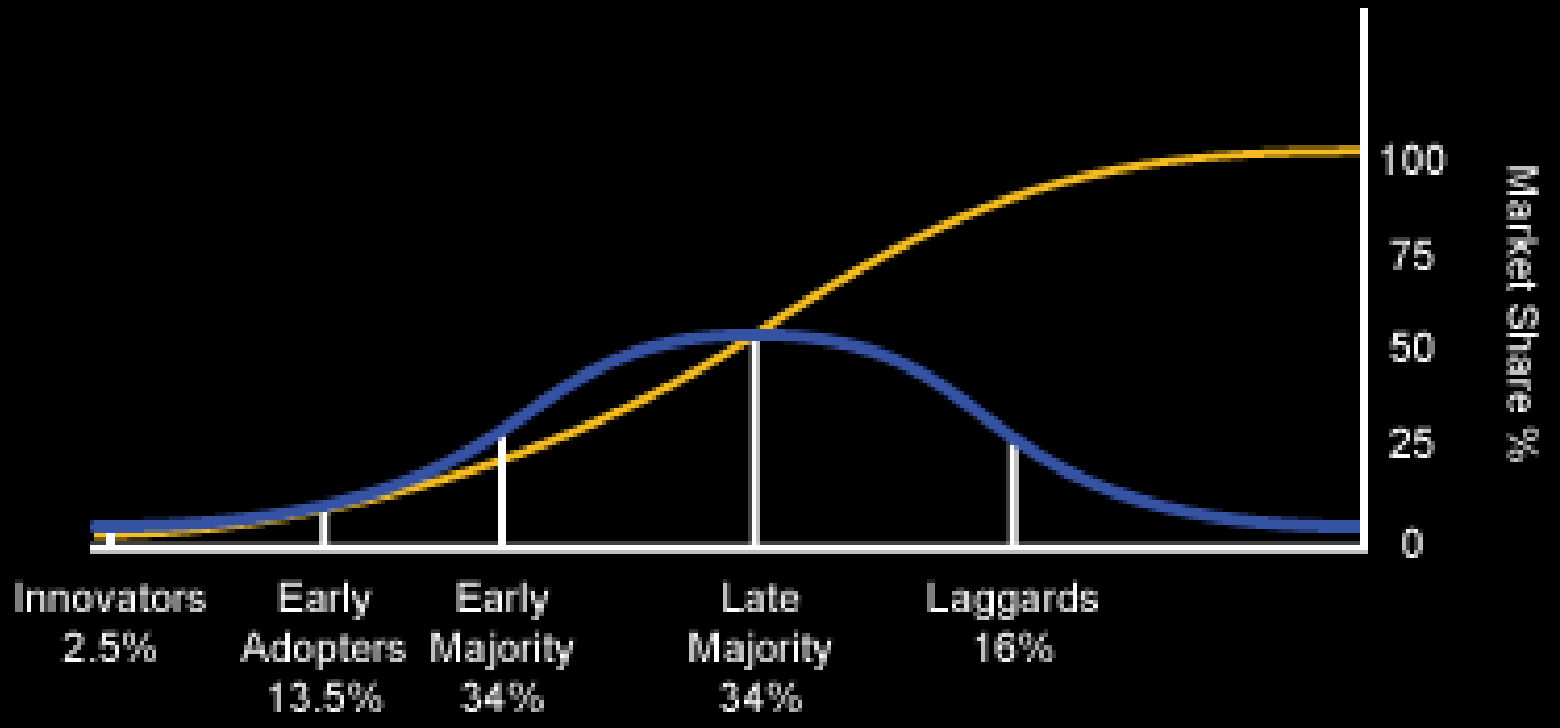
# Games Ate VR For Lunch

# And Took Our Lunch Money




Gartner Hype Cycle
Peak of Inflated Expectations
Plateau of Productivity
Slope of Enlightenment
Trough of Disillusionment
Technology Trigger


100
75
50
25
0
Market Share %
Innovators
2.5%
Early
Adopters
13.5%
Early
Majority
34%
Late
Majority
34%
Laggards
16%

The New York Times

MONDAY, APRIL 10, 1989

Two people might one day play simulated tennis with each other without leaving their living room.


# What Is Artificial Reality? Wear a Computer and See

By ANDREW POLLACK

MOUNTAIN VIEW, Calif. — Architects now design buildings on paper or computer screens. But some computer scientists envision that architects will one day be able to simulate walking through a building, grabbing and repositioning columns and doors with simple movements of the hand.

Such a vision might sound far-fetched, but computer scientists are already at work on systems that would allow people to interact with computers in profoundly new ways. Wearing a special helmet and gloves, people would feel immersed in three-dimensional computer-generated worlds and could control the computer by using their hands in a natural

Two people might one day play simulated tennis with each other without leaving their living room. And because simulations need not be limited to what can occur in

might experience life as a molecule mingling with other molecules.

### Years Away From Reality

Such advanced simulation systems are being called artificial realities, virtual realities or virtual environments. The word virtual is used in the computer industry to refer to what appears to be present but is not.

Useful artificial reality systems are still years from, well, reality.

The helmet-and-glove systems, for example, can cost as much as $300,000, and technological hurdles remain. Despite these obstacles, however, pieces of the technology are starting to be applied in education, game playing, medicine, robotics and avionics.

"The virtual environment gives you the opportunity to actually feel present, and I think that's a compelling illusion," said Michael W. McGreevy, a research scientist at the National Aeronautics and Space Administration's Ames Research Center here.

### 'New Level of Reality'

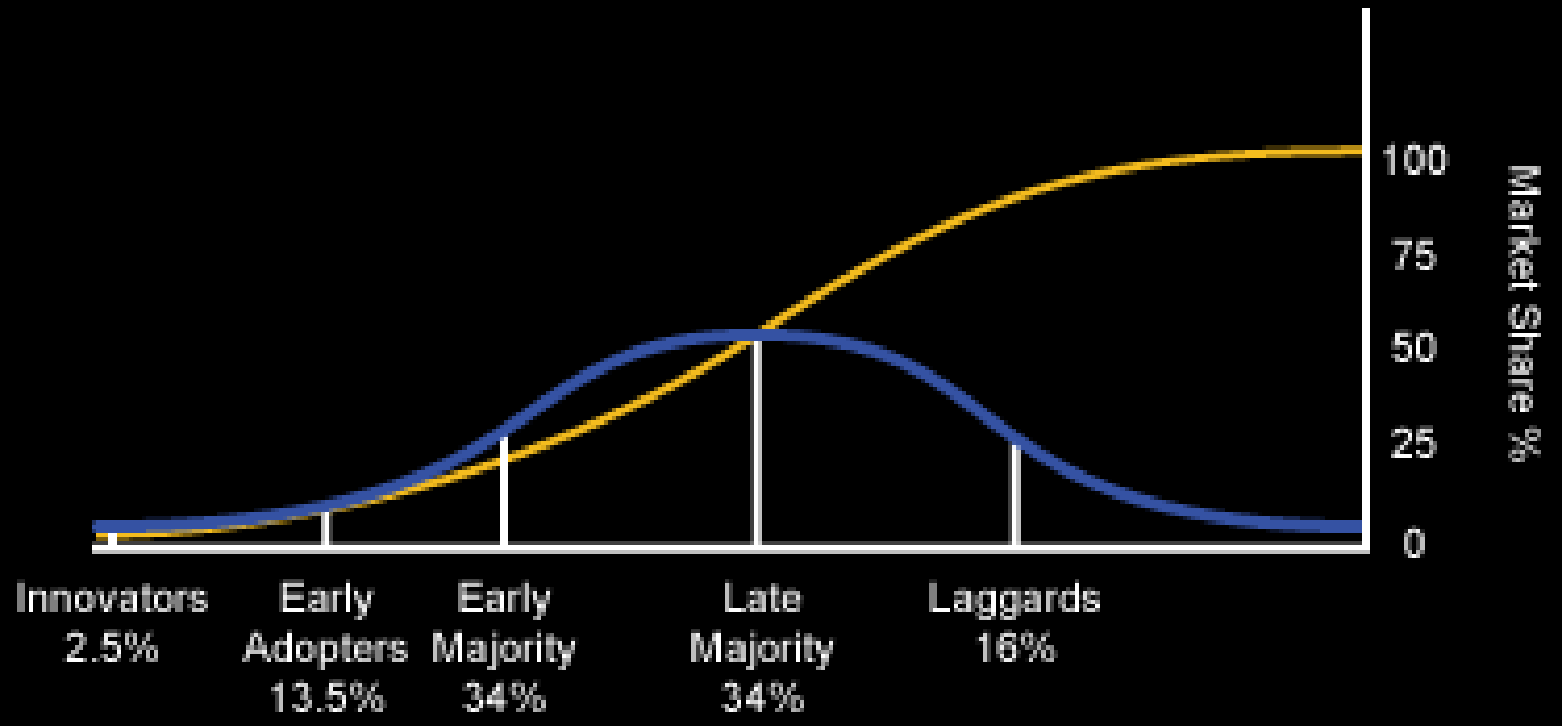
Jaron Lanier, founder and chief executive of VPL Research, a company in Redwood City, Calif., that makes gloves and other "computerized clothing" for use in virtual environments, sees a day when these systems will be far more important than mere computers or even television.

"It's a new level of reality," said Mr. Lanier, a 28-year-old programmer who has become a guru of the artificial reality movement. "There's never been another one except for the physical world, unless you believe in psychic phenomena."

A system developed at NASA

Continued on Page C2, Column 4

17 Years later

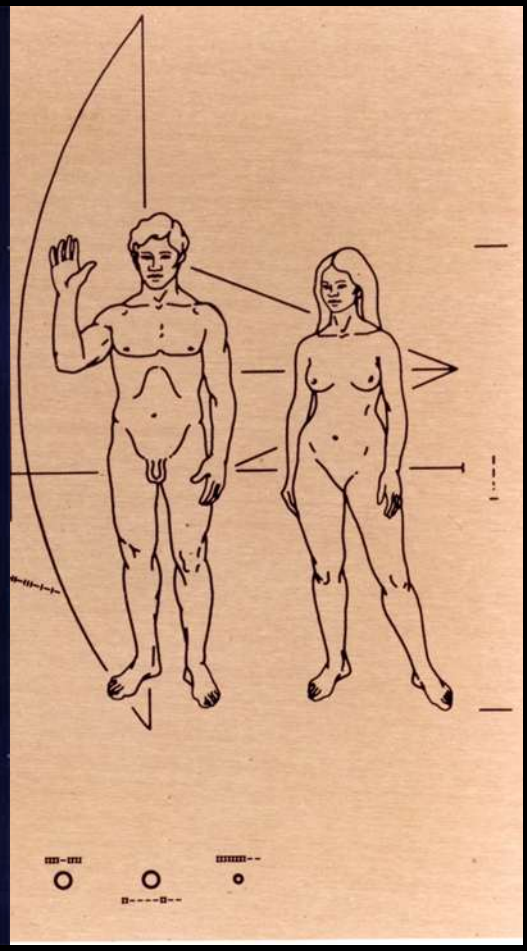



What is it that will give users a reason to engage with Augmented Data?

# Oh.

# Mobile

# AR Probe Into Culture

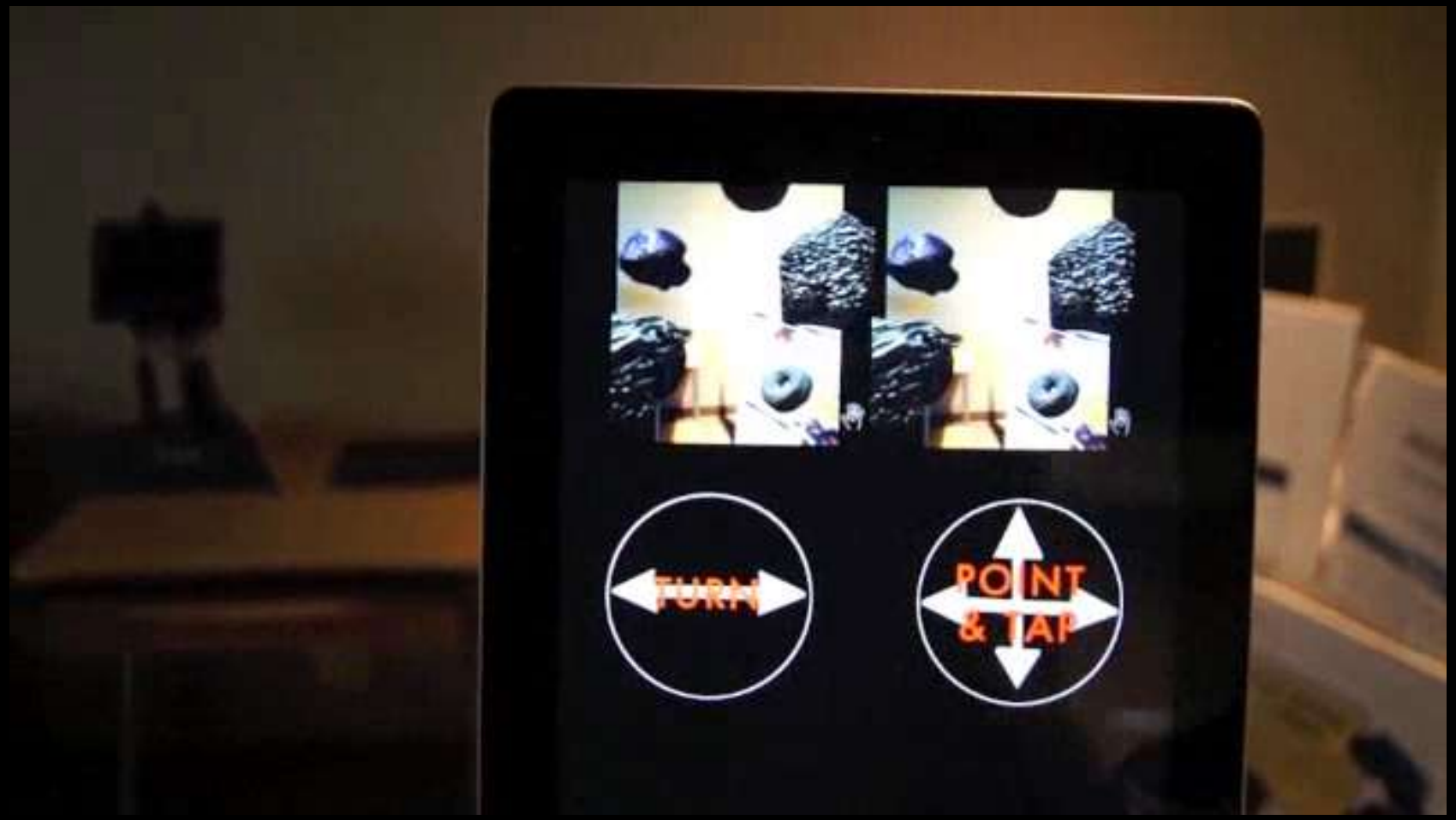



ICT
USC School of Cinematic Arts
fov2go
diy.mxrlab.com
Fakespace Labs
Research

# “Best of E3”

# Columbia: AR Windows Phones


Innovative Training Games for
Smartphone-Based Head-Mounted Displays
FOV2GO
DIY!


TURN
POINT
& TAP

# Augmented What?

Reality is Volumetric

Reality is Framed

Reality Is Malleable

Reality is Toast

Reality is Mobile

# Thank you

*David Nelson, David Krum, Evan Suma, Thai Phan, Adam Jones, Palmer Luckey: USC ICT*

*Scott Fisher, Perry Hoberman: USC SCA*

*Peter Preuss, Seraphin Diaz: Qualcomm*

*Mary Whitton: UNC*

*ISMAR 2012: Blair MacIntyre and Greg Welch*

Microsoft