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

Perceived Sound Location by Listener Position and Audio Presentation

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
### Distance Judgment Accuracy

<table>
<thead>
<tr>
<th>Condition</th>
<th>Time (min)</th>
<th>Accuracy (%)</th>
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<tbody>
<tr>
<td>150° FOV</td>
<td>15</td>
<td>70 ± 1 SEM</td>
</tr>
<tr>
<td>60° FOV + LED</td>
<td>10</td>
<td>75 ± 1 SEM</td>
</tr>
<tr>
<td>60° FOV</td>
<td>5</td>
<td>80 ± 1 SEM</td>
</tr>
</tbody>
</table>

A. Jones, E. Swan, S. Ellis, M. Bolas
Reality is Malleable
Stretching Space

Impossible Spaces, Suma, Lipps, Finkelstein, Krum, Bolas, IEEE VR 2012
Translates to Augmented

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

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
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

OUT RATE: 19 breaths per minute

FIDGETING RATE:
Left knee: 84 vibrations per minute
Right knee: 90 vibrations per minute
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

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
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 and images of the houses you see are for sale—along with the asking price, number of baths and square footage.

Have you 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 sportscasters 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, AE]
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, heighting and repositioning columns and doors with simple movements of the hand.

Such a vision might sound farfetched, 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 rooms. And because simulations need not be limited to what can occur in real life, a chemistry student might experience life as a molecule merging 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 isn’t.

Useful artificial reality systems are still years from workable.

The head-set and glove systems, for example, can cost as much as $50,000, and technological hurdles remain. Despite these obstacles, however, pieces of the technology are starting to be applied in education, game playing, medicine, robotics and aviation.

"The virtual environment gives you the opportunity to actually see a real person, and I think that’s a compelling reason," said Michael W. McGraw, a research scientist at the National Aeronautics and Space Administration’s Ames Research Center here.

New Level of Reality

Jaune Larson, founder and chief executive of VRL Research, a company in Richmond City, Calif., that makes gloves and other "immersant clothing" for use in virtual environments, sees a day when the new systems will be far more important than more conventional entertainment.

"It’s a new level of reality," said Mr. Larson, a 36-year-old programmer who became 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 1
Games Ate VR For Lunch
And Took Our Lunch Money
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
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 intervene walking through a building, grabbing and rearranging columns and doors with simple manipulations 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 belt, shirt and gloves, people would feel immersed in three-dimensional computer-generated worlds and could control the computer by using their hands at unusual angles.

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, they might experience life as a molecule migrating 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.

17 Years later
What is it that will give users a reason to engage with Augmented Data?
Oh.
Mobile
AR Probe Into Culture
fov2go
diy_mxrlab.com
“Best of E3”
Columbia: AR Windows Phones
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