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Environmental design and emerging technologies: Today and the near future

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Environmental design and emerging technologies: Today and the near future

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ABSTRACT

Technological advances over the past 10 years have caused some significant changes to the design of the built environment. These developments, and others like them, promise to change more than just *how* we design; they will very likely change *what* we design as well. The authors will present the connection between these developments in a way that projects, realistically, how technology will affect, and are employed by, the design professions in the next five to ten years. Further, the authors will address the promises and pitfalls of embracing virtual environments as the domain of environmental design.

In 2007, Blaise Aguera y Arcas demoed Photosynth (1, see appendix), a software capable of compositing publicly available online photos, like those on Flickr (2), into a navigable, three-dimensional construct while Cisco and Musion systems teamed up to showcase the first real time holographic presentation on stage (3). Online, Jon Brouchoud opened an exhibit of "Reflexive Architecture" (4) in a three-dimensional virtual environment called Second Life (5). Brouchoud's virtual exhibit included walls that moved in response to an avatar's presence, and color-changing floors that followed visitors' movements.

The next year, the National Science Foundation awarded a grant of \$920,000 to the KeckCAVES group in support of their work developing technology capable of changing four blank, white walls into an immersive virtual environment, completely customizable to the user (6). With this valuable advancement, virtual developments like Brouchoud's came one step closer to the real.

In 2009, the Augmented Reality Team demoed a sample

of how their augmented reality projections could be coupled with existing, accessible technology (here, Second Life) to enhance distance collaborations (7). This project, similar to KeckCAVES' work, only requires special eyewear to see virtual, three-dimensional objects projected into real space (8).

In the same year, two important projects were announced. SixthSense (9) and Project Natal (10) offer digital interfaces that react with real world people and objects to further blur the line between real and virtual. SixthSense, at the time of its debut, required only color-coding to recognize human gestures; Project Natal recognizes body movement, natural gestures, and facial expressions without any assistive devices.

The relationship between the built environment and the virtual environment is changing. What new advancements will we see in the next few years? In a world of rapidly-developing technologies, environmental designers will play a crucial role in determining when and how to merge virtuality with reality. Increased availability and accessibility of immersive technologies will force design professionals to broaden our thinking of the natural and built environments as the "physical world"; perhaps our realm of practice will soon include virtual environments as well.

The authors will briefly present a chronology of recent and upcoming developments in the virtuality-to-reality bridge and will address how design professions will affect and be effected by this *brave new world*.

NARRATIVE

INTRODUCTION

While the technological affordances of computer-aided design have long been a part of the Interior Design curriculum, the past ten years have brought many advances to three-dimensional modeling and visualization, creating new challenges and opportunities for educators. Virtual worlds, augmented reality, and related developments not only afford new ways of visualizing designs, but may offer new *places* to be designed themselves. The pace of technological change requires educators to stay abreast of these developments in order to best prepare students for professional employment in an environment that is sometimes difficult to even envision.

The authors will introduce recent technological developments and will present the connection between these developments in a way that projects, realistically, how technology will affect and be employed by the design professions in the next five to ten years. Further, the authors will address the promises and pitfalls of embracing virtual environments as a domain of environmental design. Specifically, this includes emerging virtual worlds as design and visualization tools, virtual worlds as sites for design work, and the mixing of virtual and real elements in real-world spaces (often referred to as mixed reality or augmented reality—two closely related but distinct concepts).

TIMELINE OF EMERGING TECHNOLOGY

In 2007, Blaise Aguera y Arcas demonstrated Photosynth (1, see appendix), a software application capable of compositing publicly available online photos, like those on Flickr (2), into a navigable, three-dimensional construct, thus bypassing the need to manually construct three-dimensional models of real spaces. In other words, given the availability of enough two-dimensional photographs—no matter who took them—Photosynth can stitch together a three-dimensional model of the space.

That same year, Cisco and Mursion systems collaborated to create and showcase the first real-time holographic presentation on stage (3). Whereas conventional “virtual meeting” tools simply display offsite participants on life-size monitors, the holographic system projects an apparent three-dimensional body into space.

Online, Jon Brouchoud opened an exhibit of “Reflexive Architecture” (4) in the multiuser, three-dimensional virtual environment of Second Life (5). Second Life allows its users to create realistic computer-generated buildings and other spaces, which they can then “inhabit” through puppetlike avatars that inhabit the space and provide a means for interacting with others. In Brouchoud’s virtual exhibit, walls moved in response to an avatar’s presence, and color-changing floors followed visitors’ movements. In short, the virtual environment became directly responsive to the behavior of its inhabitants.

The next year, the National Science Foundation awarded a grant of \$920,000 to the KeckCAVES group in support of their work developing technology capable of changing four blank, white walls into an immersive virtual environment, completely customizable to the user (6). Such an environment is far more immersive than a single computer screen because the user is literally inside it. With this advance, interactive projects like Brouchoud’s came one step closer to the real.

In 2009, the Augmented Reality Team at Georgia Tech demonstrated an example of showing how their augmented reality projections could be coupled with existing, accessible technology (here, Second Life) to enhance distance collaborations (7). This project is similar to KeckCAVES’ work but requires special eyewear to see virtual, three-dimensional objects projected into real space (8).

In the same year, two important projects were announced. SixthSense (9) and Project Natal (10) offer digital interfaces that react with real world people and objects to further blur the line between real and virtual. SixthSense, at the time of its debut, required only color-coding to recognize human gestures; Project Natal recognizes body movement, natural gestures, and facial expressions without any assistive devices.

These developments could each be seen as separate projects, but they are also interrelated contributions to what has been described above as mixed reality or augmented reality. As such, they are individual steps along the same real/virtual continuum. The possibilities afforded by a convergence of two or more of these developments are worth exploring further in the context of an open forum, which is planned for the second half of the conference presentation.

Problematizing The Real and The Gaze

These developments also challenge our conceptions of The Real. Augmented and mixed reality constructions are not “really there,” it might be argued, but how much of a “real” interior is already virtual? Paintings and photographs on the walls are one example of virtual reality already existing in the home. Ink collects in zones of tonal value to create two-dimensional representations of people and places. Scented, plug-in air diffusers mechanically superimpose their representations of “sea breeze” over the natural smells of the home. Electronic signals—which we label as music or talk radio—pass through speakers and are translated into audible waves. Microfiber fabric covers sofas, forced air ventilation provides the sensation of stable temperature, and “real feel” silk plants simulate the look and feel of real vegetation. The average human being spends 90% of his life (Day, 2002) inside what could arguably be called a *virtual* environment.

If one can understand the built environment to be - to some extent - virtual, then it is possible to envision a near future in which virtuality is harnessed to improve the built environment. Despite all the the advances described above virtual environments are still largely *visual* environments. (Humans rely most heavily on vision, of all the available senses.) The technology behind the work of KeckCAVES, Georgia Tech, and Cisco and Mission (described above) is the same type of technology that could adapt easily to the practice of interior design. Consider the fact that crown moulding, wall covering, and framed art are three aspects of a design that are generally meant to be *seen* rather than touched. And imagine using projection technologies to design a space in which these three aspects could be changed at the flip of a switch. The repainting of a room would no longer be subject to the restrictions of time, cost, environmental impact, or indoor air quality. Wall finishes could be selected once, based on their practical properties, and their appearance re-imaged as often as needed. Possibilities such as these are further explored in the conference presentation.

Yet a human needs more than a projected image of egg and dart moulding to thrive. When we embrace the promises of technology too eagerly we forget that it is but a means an end. Social and technological change has always raised philosophical dilemmas; this thresh-

old to a *brave new world* is no different. One critique of many virtual environments in existence today is their reliance on the visual medium, which reinforces what Martin Jay and others have referred to as a modern hegemony of vision. This “Cartesian perspectivalism” valorizes rationalism and geometric relations as underlying “truth” and can be seen in the familiar perspective lines in a drawing and the wireframe substructure of a computer-generated object. This further reinforces colonialist and gendered notions of the “gaze” (Urry, 1990) that place the observer outside of and unaffected by the observed. Both notions become problematic when we consider the very pragmatic implications of real bodies in real spaces.

THE REALITY OF ENVIRONMENTAL DESIGN

The relationship between the built environment and the virtual environment is changing. What new advancements will we see in the next few years? We foresee three important trends:

- Greater public participation in visioning processes and more reliance on virtual constructions as part of the design process.
- Increased need for environmental and interior designers within virtual worlds like Second Life, which replicates the spaces of the real world but offers unique challenges and opportunities because of differences in physics, point of view, and embodiment.
- More mixed-reality spaces that contain “unreal” components that are nevertheless pragmatically embedded in our experience of those spaces.
- Shift from training students to use “the one best program” in depth, to teaching them generalized knowledge and skills that will allow them to adapt to rapidly changing technologies.

Increased availability and accessibility of immersive technologies will force design professionals to broaden our thinking of the natural and built environments as the “physical world”; perhaps our realm of practice will soon include virtual environments as well. As educators, we can and must prepare our students in established traditions as well as give them the ability to embrace change and extend their horizons. By attending to and incorporating these new technological developments into de-

sign curricula, educators can help students foresee new possibilities as well as potentially avoid new pitfalls.

APPENDIX

A short introduction to referenced technologies.

(1) Photosynth

http://www.ted.com/index.php/talks/blaise_aguera_y_arcas_demos_photosynth.html

(2) Flickr

<http://www.flickr.com>

(3) Cisco Telepresence Magic

http://www.youtube.com/watch?v=rcfNC_x0VvE&feature=channel_page

(4) Reflexive Architecture

<http://www.youtube.com/watch?v=XBtma6YXAis&feature=Playlist&p=1AF4E617D2978B95>

(5) Second Life

<http://secondlife.com/>

(6) KeckCaves

<http://keckcaves.ucdavis.edu/>

(7) Augmented Reality Team

<http://virtual.vtt.fi/virtual/proj2/multimedia/>

(8) Augmented Environment Laboratory

<http://www.cc.gatech.edu/ael/>

(9) SixthSense

http://www.ted.com/talks/pattie_maes_demos_the_sixth_sense.html

(10) Project Natal

<http://www.youtube.com/xboxprojectnatal>

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