digital windows

cause + effect  between  reality + virtuality
abstract

Digital Windows allow real people in the real world to interact with virtual objects in a virtual world through a direct relationship between real-space and digital-space. Actions in the real world are affected by re-actions in the virtual world.

As a Master’s Thesis Project, the scope of Digital Windows is that of a prototype for a larger vision. This vision suggests the potential for Digital Windows to be a group of input/output nodes (located in separate, yet related places) that allow physically distant by-passers to interact with each other. It will take a pause at a node to see it as more than something hanging on a wall; and, several pauses to understand the interaction with people at the other nodes. This, in essence, becomes a progressive discovery with each by-pass that results in a pause. Environmental psychology might associate this process of discovery with arousal (physiological reactions). Arousal fluctuates directly with the complexity of what is going on. One way to keep things simple for by-passers is to treat them as by-passers, and require nothing of them. As windows allow us to see specific parts of other places; the content of this project is a virtual space ‘between’ some real spaces. The real spaces at each node have unique points-of-view into the shared virtual space, through respective digital windows. Objects in the virtual space are the devices of a cause and effect interaction between the real world and the digital world.
Even with modern advances, the typical experience of space is static; meaning that ordinary buildings do not actually respond to people—in terms of spatial experience. Some building systems are automated using modern technologies. Currently these technologies only serve experience-degrading economics (Ansuman 2005).

These systems do not change the spaces they serve; they subtly regulate the conditions of space. Experience of space is not changed if people do not identify their influence on these dynamic systems. It is not the nature of technology that numbs the experience of space; it is the economic concerns that are ignorant to the qualities of interactive architecture.

There are many examples of interactive architecture whose technological applications strive to interactively change the experience of space. Following are descriptions of three examples, each with strong social correlations. These projects have clear reasoning for technology: the BIX in Austria, the HypoSurface by dECOi, and Arch-OS from i-dat.org.
The bio-morphic form of BIX is not necessarily unique in concept, but the purpose and implementation is unique. Behind each of the hundreds of clear tiles is a fluorescent light. Each light is individually controllable and can change degree of intensity between full-on and full-off. The surface was designed to be a giant information display. The social interaction of this project is in the ability for anyone to manipulate the display surface over the internet.
HypoSurface

The Aegis Hypersurface is an otherwise simple long wall surface made up of hundreds of steel triangles connected together at the corners, not the edges. The ‘wall’ physically deforms by the extension and contraction of pistons connected to the triangle corners.

The deformations are responses to ambient sound, direct video input, or mathematical formulas. The performance can be abstractly similar to ‘funny mirrors’, wherein people can see 3D reflections of themselves.

specifically personal interaction with form
Arch-OS

Arch-OS is in all reality an Architectural Operating System—that goes well beyond the economically constrained smart building systems. One aspect of Arch-OS attempts to mitigate social activity. The system employs large slow moving robots called SlothBots, which in essence are social shepherds.

The SlothBots are programmed to physically herd social activities based on occupancy analysis. Although the intent is for people to not be aware of the changing space; the fact remains that real space is being changed by electronic definitions of what is normal.
Environmental Psychology suggests that arousal is directly tied to the complexity and duration of a task (Bell 2001); and, Robert Venturi defines complexity as having richness of meaning. “Innovative place-making encourages people to explore and participate in their surroundings. The most engaging buildings are those that invite us to take part on many levels, that stimulate all of our senses as well as our intellect.” (Czarnecki 1998)

Activities or tasks that are too complex exhaust mental capacities and lead to boredom or frustration (Bell 2001). Interactions that are not challenging enough do the exact same thing.

Providing people with a different experience in the same place, each time they pass through, is evident in the afore mentioned examples. This is key in the development of Digital Windows. The technologies and their implementations address the need to have levels of complexity that re-engage by-passers.
Our bodies provide a multi-sensorial understanding of space; the relationship with space somehow seems to go beyond point-of-view. We know our proximity to a wall without touching it; we perceive our movement in space based upon our sense of proprioception.

Our senses are as physical and real as all the world around us. This raises two major concerns with Digital Windows. The real world has limited dimensions and tangible boundaries. The digital world is completely different, there are no tangible things, and objects can be infinitely small or large.

A translation is needed between the virtual world and the real world. Mouse, keyboard, webcam, and microphone are all existing devices that translate real into virtual. Monitors, speakers, and robotics are ways of translating virtual into real.

Digital Windows is based on the bidirectional idea of cause and effect between reality and virtuality. This is done by using common one-directional technologies in ways that define and execute relationships between real people and virtual objects.

Monster Media is one of many groups making this translation through the body. The focus is on economic return—advertising and entertainment, not on spatial experience.
Substantive theory in Environmental Psychology touches on the topic of interaction with architecture as part of how people understand and assess their experiences with architecture. The previous examples reside primarily in the urban context where the weight of social interaction is heavy when compared to interaction with the technologies themselves.

Digital Windows emphasizes the interaction with the technology in order to draw more attention to the individual’s experience of the digital environment.
The very nature of computer technologies is extremely complex. The complexity holds richness of meaning to those that design and implement hardware and software. The richness is likely less appreciated by those that use the technology.

Digital Windows is remarkably more complex than meets the eye. Very little of the complete system is perceptible to an individual interacting with it. Even when the data flow is diagramed very little of the processing systems and code is comprehensible. Assuredly, each atom of the system has distinct purpose and affect on the whole.
Many of the same technologies used for input and output in prior examples, are used in Digital Windows. The goal of dynamic spatial experience, and cause + effect, guided the methods of applying these technologies.

A web camera streams a live audio and video feed into an application (Isadora) that tracks a moving object via contrasting colors. The tracked information includes; the X and Y positions, the width and height, the velocity, and ambient sound level.

The information is broadcast from one computer to another computer running a different Isadora file. The retrieved values are converted into MIDI Pitch signals that are looped to a 3D design application (3D Studio Max) that updates the respective properties of an avatar that represents what the web camera is observing.

In the digital environment inside of 3D Studio Max, the avatar interacts with other digital 3D objects. The interactions are processed through hundreds of lines of code, more than a hundred times each second.

Basically the avatar has an avatar which has an avatar. Meaning, that the primary avatar which most directly represents the person interacting with Digital Windows,
Virtual reaction imposed upon person in real world.

1 - avatar requests new position
2 - new position processed for degree of intersection
   2a - if partial intersection, then ‘stop’ avatar
   2b - if complete intersection, then ‘bump’ 3D object
3 - update processed positions for avatars and objects

Real action imposed upon digital object in virtual word.

The validity of an avatar’s position and attributes are based entirely on the concept of cause and effect between reality and virtuality. If the updated attributes would generate an intersection with existing digital objects, then the requested update is invalid. Invalid requests are handled in two ways; the request is denied and the primary avatar is not updated, or the digital object in question is ‘bumped’ out of the way of the primary avatar, which is updated.

The digital world has a direct and personal effect on the real person; and the real person has a perceptible effect on the digital world.

All of the interaction is visually presented to the person through LCD computer monitors that are windows into the digital world. The system also has the capacity to provide collision feedback with sound through the Digital Windows. [Unresolved technical issues eliminated the audible feedback during the formal presentation.]
**demonstration**

The formal presentation of Digital Windows was set up in an exhibition hall in such a way that there were two interaction zones. Each zone represented the idea of different places anywhere in the world. These spaces could be adjacent rooms, or places in different buildings on campus, etc.

In order to clarify orientation and movement, four by four grids were placed on the floor in the interaction zones. The movements in the virtual world were mapped as closely as possible to the real world. This reduced over complication that might contribute to a frustration type arousal. As mentioned previously, frustration might adversely affect perception of the system.

The digital world was kept extremely simple — almost elementary. This further helped the overall interactions between the real world and the digital world, by keeping focus on the events and actions and not the objects themselves.

The technologies used in Digital Windows have the theoretical capacity to handle multiple people in each tracking zone, and to have a very rich 3D environment. As Digital Windows was approached as a prototype, these aspects are simulated in short video clips. The clips suggest how Digital Windows might be further applied.
Many of the technology choices for Digital Windows are based on a project developed for the new Warnock Engineering Building (University of Utah). The project was a colorful light pipe, integrated into the guard rail, for the sky bridge that goes through the building’s commons areas.

The light pipe and the bridge’s glass panels were designed by the late Robert Fisher, the artist commissioned for the job. He desired that the lights be programmed to present sunset-like effects on the glass panels. As part of an architectural theory class, the light pipe was investigated for applications as an information source.

Of the several intriguing ideas proposed, I was involved with the team that suggested the light pipe could interact intimately with people as they walked across the bridge. Our final presentation for the course involved tracking a person as they walked along the light pipe, and having the light’s colors follow them.
applications

Many existing applications for Digital Windows can be derived from the applications of the other described works. Entertainment and Education are certain areas of potential exploration for Digital Windows. Other areas relate more directly to architectural design, such as a more free way to experience an architectural visualization. An area of particular interest, due to advances in Building Information Modeling, is that of Emergency Management and First Response Training.

There are many examples of systems and methods for assisting and improving current practices in these areas. Digital Windows fits interestingly between two major technological approaches; management role-playing scenarios, and ‘first-person’ immersion in virtual-reality. Both ideologies are likely excellent for their prescribed benefits. Digital Windows can potentially bridge the gap by simultaneously providing decision training, and physically-free spatial training.
David Burnell, founder of the Urban Warfare Center at OPSGEAR, sees Digital Windows as potentially offering several powerful opportunities to first responders. He agrees that operators could become very familiar with an environment before ever engaging it in action. He suggests this could allow greater control of engagement tempo.

He also mentioned benefits to the “path of least resistance” wherein decisions regarding getting-in and getting-out can be made more well-informed on the fly. This could greatly improve success in combative and non-combative scenarios where conditions are changing rapidly.
**definitions**

**arousal**
_to rouse or stimulate to action or to physiological readiness for activity_

**atom**
a tiny piece of anything

**avatar**
a graphical image that represents a person, as on the Internet

**complexity**
the quality of being intricate and compounded; “he enjoyed the complexity of modern computers” [ant: simpleness]

**ecology**
The branch of sociology that is concerned with studying the relationships between human groups and their physical and social environments. Also called human ecology.

**interaction**
reciprocal action, effect, or influence
proprioception
The unconscious perception of movement and spatial orientation arising from stimuli within the body itself.

reaction
action in response to some influence, event, etc

technology
The branch of knowledge that deals with the creation and use of technical means and their interrelation with life, society, and the environment, drawing upon such subjects as industrial arts, engineering, applied science, and pure science.

translation
to convert (a program, data, code, etc.) from one form to another
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image 5b

video 5c
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image 6a
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