Architecture User Interface

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Architectural User Interface is the name of a design studio at the College of Architecture at the University of North Carolina at Charlotte whose goal is to extend the computer interface into architectural space and engage in the design and construction of digitally enhanced architectural settings. These projects attempt to move the computer from representation to the media of architecture itself. The most promising avenues for further exploration are centered on using new conceptualization of time and space as means of architectural composition.

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Introduction

In the roughly half century since the introduction of digital computers, they have spread to near ubiquity in the culture. The reduction in size and increases in computing ability are well known.

At first, there was rapid change in the manner in input/output devices, moving from dials to punch cards to CRTs. For the last twenty years, however, the Human Computer Interface has barely budged. Given the almost vertiginous change in every other aspect of information technology, this is an odd event and an opportunity.

Virtually all general use computers (as opposed to those embedded in a car or toaster) uses a Graphical User Interface (GUI(say goo-eee)), the interface pioneered at XEROX PARC and by the Apple Mac OS using a keyboard, a mouse, a monitor, and an icon based file system.

More and more within the field of computer graphics, gaming and simulation, interest has grown in breaking free of the constraints of the monitor-mouse-keyboard paradigm. This interest goes under the name of distributed computing, tangible user interface and immersive technologies, among others. All these efforts aim to find ways to extend the computer into the physical setting, through new ideas of input devices and display methods. One example of this is Tangible User Interface (TUI(say too-eee)): the interface proposed by researchers at the Media Lab at MIT (Ishii, 1997) that extends the computer beyond the monitor into other forms that can be touched, such as wearable computers. Techniques such as CavePainting have been explored that use virtual reality techniques to make three-dimensional paintings (Keefe, 2001).

Architectural Users Interface (AUI(say ah-oo-eee)) is the interface that might exist if we think of the computer not as a means of representation, but as the media of architecture itself. Our goal has been to extend this to a fully architectural and spatial design realm.

The general case for a shift in the realm of building has been clearly articulated (Mitchell, 1995), but the argument for how it will affect the nature of architecture design practice is less well understood.

Until now the use of the computer in design studios at schools of architecture has been limit-
ed almost exclusively to the representation of architectural space, structure and materials. For example, of all the papers publishing in the proceeding of ACADIA in the years 1996–2000 (ACADIA 1996-2000), only one paper deals with the idea of the computer as a venue of design rather than as a means of representation.

**Studio Projects**

This work has been undertaken as part of an advanced architectural design studio for both undergraduate and graduate students at the College of Architecture at the University of North Carolina at Charlotte. Students entering this studio had a wide variety of background in computer applications, ranging from virtually none to a working knowledge of 3D modeling (FormZ) and full animation (Cinema4D) programs. The first half of the 14-week studio dealt with the idea of architecture user interface outlined in this paper.

**Prelude: Representing architectural environments**

The first two weeks were devoted to bringing students up to speed on the use of FromZ and Cinema4D through a series of introductory exercises. This introductory work paralleled the canonical use of the computer as a means of representation that is the most common use in practice. With both programs, the focus of the investigations was on the use of animation and sequencing as tools of design.

The emphasis with FormZ was on the ability of the computer to replicate stages of iterative design process and on the ability of the program to simulate motion through environments. Since FormZ is limited as an animation tool to the motion of one camera only, we extended our exploration to the use of Cinema4D, which has to the ability to animate multiple objects, lights and cameras. Using this broadened pallet, we were able to explore ideas of moving objects in architectural environments, including building components, lights and multiple views overlaid simultaneously.

**Phase One: Installation/Media in architectural space**

For the next two weeks, students were asked to create architectural representations which was intended to be placed in specific environments. Examples of five projects (Figures 1-5) are shown below, but for illustration purposes I will describe in detail the “Virtual Corridor Installation” by Darian Walker (Figures 1).

This project modeled a corridor in the College of Architecture using FormZ, and subsequently created a movie of the virtual corridor simulating motion down the corridor in exactly the same linear motion as people using the real building are forced to follow. He then used a video projector to cast the movie on a fabric screen placed halfway down the corridor. The video loops and is viewable from both sides of the screen. The result is both direct experience of the corridor and virtual experience of the movie. The placement of the projector in the hall adds an unexpected dimension to the installation as it cast a shadow of anyone in the hall onto the scrim.

**Phase Two: Architectural User Interface**

For the next three weeks, the students worked in teams to design installations that incorporated active control by computer interface using X-10
remote sensing and control systems. These sys-
tems use power lines as carrier to send and receive signals from remote modules. While this system is relatively crude, it is inexpensive and readily available.

The key difference between the Installation/ Media and the Architectural User Interface is that we now had the capability to have actions by the user directly influence the installation. The X-10 technology is simple, especially the remote sen-
sors, which are very sensitive and liable to inter-
ference on the power lines. Accepting these limi-
tations, the students worked in teams, creating three compositions.

Light Room (Figure 6) was a 15-foot square room that was completely without windows and in which light could be completely controlled. A series of three fabric scrims and 6 spot lights were placed in the room in such a way that one's ability to see through the scrims varied depending on which lights were on, and their relative power. The computer was used to control the lights activated by remote sensors. The lights brightened or dimmed in increments, and together with the scrims changed the perceived character and extension of the space.

Injection Scene (Figure 7) was an installation of a camera, a video projection system and a monitor. Theses elements were arranged in such a way that as one looked at the video projection, the video camera captured an image of the user and the projection screen and sent them to a monitor (and later a head mounted display). You see yourself placed into a virtual environment, and you are able to see yourself moving through it. Sensors were used to correlate with specific locations that triggered changed in the display. The effects were very simple (moving forward and back in the scene).

Findings and Further Investigation
The work reported in this paper is intended to open avenues for design investigations, particularly in the controlled settings of schools of architecture. It seems clear that the following conclusions can be drawn from this work:

- The control systems available to designer are likely to remain relatively crude, and it is unwise to expect them to be capable of fine gradation of control. This contrasts with systems optimized for HVAC or building automation systems, but these are likely to remain highly specialized.
- The effects most likely to be immediately use-
ful to architectural designer are involved with dislocations of time and location.
- Until now, time has been conceptualized, if at all, as a metaphor (for example by Gideon as the fourth dimension (Gideon, 1982)) or as a slow weathering (for example by David

Figure 6. AUI: Light Room (J Solomon, D. Walker, P. Yagla, M. Fisher)
Leatherbarrow (Leatherbarrow, 1993). Based on this work, it is possible to imagine an architectural composition that incorporates time literally within the architectural composition, changing the character of the spaces and our perceptions of how we move through them.

- Form and space has been seen as the stable underpinning of architectural composition. The ability to connect space electronically and short circuit the physical realm open possibilities for architecture. Compositions may come to more closely resemble mobius strips or klein bottles than simple two dimensional diagrams. Investigations of the use of the computer as a means of architectural composition will be incorporated into the introductory student studio work as an extension of the introduction to computers as a means of representation.

Peter Eisenman has written about architecture being able to “look back” at the traditional subject (man) of architecture (Eisenman, 1992). Although dressed in the cloak of an investigation of electronic media, he uses this mostly as a metaphor for his development of a “folded” leit motif in a particular building design. But it is possible to imagine a building look back and not forming one stable object, but changing over time and through space. This will have implications beyond the representation of architecture (leading us, for example, to use effectively full animation programs) but also for the nature of architecture and its physical presence.

References