RESPONSIVE SPACES: MOTION, ACTIVITY AND INTERACTIVE ART

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We present an overview of interactive art that reflects human activity in physical space. We discuss the varied approaches of these pieces and present our own work, Building with a Memory, which is situated in a workplace and builds on this prior work to provide an informative and aesthetically satisfying experience.

Fig 1. Four approaches to representing human activity in interactive art. Top Left: Urban Pixels by William Mitchel and Susanne Seitinger. Top Right: You Are Here by Snibbe Interactive. Bottom left: Motion Traces by Tmema (Golan Levin and Zachary Lieberman) with Ars Electronica Futurelab. Bottom Right: Artifacts of the Presence Era by Fernanda Viegas. All images © respective artists.

Fig 2. Building with a Memory uses wall-mounted LED lights and a video display (see inset detail) to present current and historical human physical activity in a multi-use workplace. Copyright Arizona State University 2011.

Introduction

Sensing and responding to dynamic human activity occupies a rich position in the history of interactive art. Artists such as Camille Utterback, Golan Levin and Petra Gemeinboeck explore human movement as a physical, distributed and social phenomenon. Their work and that of the broader community engaged in creating responsive experiential art is the focus of our research and the inspiration for our creative experimentation.

We present an overview of works that track and display human activity, particularly movement. We focus on the temporal and spatial lenses each work adopts in interrogating and responding to human movement. The purpose and provocation of these installations range from utilitarian to aesthetic. Works such as Ishii's *Pinwheels* provide information on social and technological interactions. In contrast, Rokeby's *San Marco Flow* and Gemeinboeck's *Impossible Geographies* render patterns of movement at vastly different scales and require varying levels of conscious participation. The works represent varying approaches in feedback mechanisms, analysis of captured data and scale of detected and represented activity.

Inspired by these works, we introduce *Building with a Memory*, an interactive installation that captures and represents human movement in a collaborative workplace. Unlike other workplace media systems which often focus on interpersonal communication, we design an aesthetically-informed system that provides both artistic and informative value. We explore co-located and distributed sensing and feed-back, and display activity over scales varying from a single room to the surrounding environment. Recording, analyzing and representing the ebb and flow of activities over time provides opportunities to develop insight into the community, for members and visitors alike. We use indirect lighting and video

to provide ambient feedback. While we capture activity over time, we mask identity of individuals to maintain privacy while providing practical information on the history of the community.

A Survey of Bodies and History in Interactive Art

Some artists use the opportunities provided by interactive media to catalyze interaction with others in under-utilized public spaces, or increase awareness of the history of space. Other artists produce installations that encourage in-depth interaction between individuals and installations. Others use these mediums to make the viewer aware of the patterns of everyday activity in public spaces. Still others use these technologies to augment the workplace, providing ambient information to everyday users of the space. Each of these approaches has implications for the type of sensing and feedback, level of abstraction, and kind of historical and current data presented.

Many pieces encourage interaction between viewers and the installation in public space. Camille Utterback's *Aurora Organ* and *Abundance* exemplify this style of interaction. *Aurora Organ* invites patrons to engage with each other and six LED-lit acrylic columns through touch panels embedded in a lobby space's railing. By touching the interfaces, patrons can contribute splashes of color to the corresponding column; special cases reward patrons for working together to trigger all sensors at once. *Abundance*, a public-art installation in a building's courtyard, uses a projection mapped onto a building for output, and computer vision for input. Activity is captured as brightly-colored silhouettes that leave behind traces, which fade over time to lines. Certain patterns of activity trigger special responses, encouraging people to play in the environment created by the installation.

Pieces that encourage interaction between people in the context of the media system serve a different purpose. Snibbe Interactive's *You Are Here* (Fig. 1, upper right) is situated in a museum exhibit rather than a public lobby or courtyard. Like *Abundance*, *You Are Here* uses video to extract the paths of individuals through the space. In *You Are Here*, video from multiple cameras is digitally stitched to detect movement throughout the entire exhibit floor. *You Are Here* focuses more on literal history than *Abundance*'s abstracted silhouettes. The installation's display and controls are located in the sensed space, and viewers can hide or show the video image and adjust how much history is displayed. The exhibit catalyzes discussion about surveillance, tracking and recording of history in the context of the larger museum exhibit's discussion of computation and technology, in addition to encouraging specific kinds of interactions.

Jason Bruges Studio's *Shortcut* integrates computer-controlled lighting into the pavement of an urban alleyway. The installation senses movement through the alley, and reflects this motion in patterns of light. Rather than encouraging performance or interaction among people present in the space, the installation reflects their motion, building up patterns of light over time. This creates a pleasing interaction in what was previously a dark alleyway, and also improves the safety of the space by providing lighting when people are present. The lighting changes are immediately visible to the participants, but also leave traces for subsequent viewers to interpret.

Mitchel and Seitinger's *Urban Pixels* system supports an interaction where participants use flashlights to trigger individual LED lights, setting off patterns of activity across the other networked devices (Fig. 1, top left) [5]. Like *Shortcut*, *Urban Pixels* responds to human activity with light. *Urban Pixels* has a more flexible spatial layout, and one instantiation requires people to choose to interact with the pixels using a flashlight rather than passively sensing their motion.

Lozano-Hemmer's *Pulse* family of installations, including *Pulse Room*, *Pulse Spiral*, and so forth, use a single tangible object to provoke interaction. By gripping a heart-rate sensor, viewers can contribute their pulse to the installation. Each participant's pulse is visualized as a flickering incandescent light into an array of light bulbs, each representing a participant's heart beat. Lozano-Hemmer uses these captured heart-beats as stand-ins for individual identity, and through this metaphor presents an abstract, ephemeral history of the work's viewers.

Levin et al's *Motion Traces* (Fig. 1, bottom left) uses computer vision techniques to control a projection and multicolored lighting in one corridor of a retail space. The installation presents multiple variants of feedback, each of which maps the position of visitors in the corridor to an abstract video rendering. The system is primarily commercial art -- it serves to entice visitors into the retail space and build positive associations with the brand.

Another tradition of installations considers human motion through public space, without displaying the analyzed motion to the sensed population. Rokeby's *San Marco Flow* fits into this category. Like *Abundence* or *You Are Here*, the installation uses a camera to capture motion through a large public space. Unlike these other pieces, where the generated feedback is visible to the sensed population, *San Marco Flow*'s video feedback exists inside a gallery space. The majority of people contributing sensed motion to *San Marco Flow* may not even realize that they are being sensed.

References and Notes:

1. *Petra Gemeinboeck, "Impossible Geographies of Belonging" (paper presented at the 13th Annual ACM International Conference on Multimedia, Singapore, 2005).*
2. *Erving Goffman, The Presentation of Self in Everyday Life. (New York, NY:Anchor Books, 1959).*
3. *Hiroshi Ishii, Craig Wisneski, Scott Brave, et. al. "ambientROOM: integrating ambient media with architectural space" (paper presented at the CHI '98 Conference on Human Factors in Computing Systems, Los Angeles, 1998).*
4. *Hiroshi Ishii, Sandia Ren and Phil Frei, "Pinwheels: visualizing information flow in architectural space" (paper presented at the CHI '01 Conference on Human Factors in Computing Systems, Seattle, 2001).*
5. *Susanne Seitinger, Daniel S. Perry and William J. Mitchell, "Urban pixels: painting the city with light" (paper presented at the CHI '09 Conference on Human Factors in Computing Systems, Vancouver, 2009).*
6. *Viégas, Fernanda, Ethan Perry, Judith Donath, and Ethan Howe. 2004. Artifacts of the presence era: Visualizing presence for posterity. Los Angeles, CA.*