Ten Inch Pixels: Ambient Art for Remote Awareness

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ABSTRACT
We present an ambient display for supporting social connections between extended family members. The display, a digitally-controlled combination of oil on canvas and mechanical sculpture, consists of four, ten-by-ten inch "pixels," supporting the display of five coherent images and hundreds of mixed, collage images.

Keywords: Ambient display, art and technology, computing in the home.

INTRODUCTION
Ambient displays, such as the ambientROOM[2] and AudioAura[3], have the potential to augment physical places with information about distant people and events while remaining primarily in the periphery of the user's attention. These displays have some unique properties not found in standard interfaces. Ideally, they are pleasant for their own sake, require minimal attention, and generally convey non-critical information. In addition, they can make the transition from the background into the foreground of the user's attention by becoming more "active". For example, the noise level of the Information Percolator[1] and the Dangling String[4] can be increased dramatically due to the mechanical nature of those displays when appropriate.

Our display is motivated by a broad research effort in future home technologies to support elderly individuals living independently in their own homes. One key aspect in this complex problem is strengthening social connections between physically distant family members. A guiding scenario underlying our design is that an adult child of an elderly woman would hang this display in his or her home. The display would be driven by a variety of ubiquitous sensing technologies in the elderly woman's home that also support her day-to-day activities (e.g. sensing potential crisis, aiding medication management). Dynamic changes in the display could convey specific (e.g. "Mom had a bad/good day") as well as general (e.g. "Something has changed") messages in an aesthetically pleasing, non-intrusive and privacy preserving manner.

ARTWORK
The paintings[1], created for this research, revolve around a series of five coherent images (see Figure 1) focussed on the theme of family and aging. Taken as a whole, these images tell the story of a woman and her family as it changes over time. They represent a reflection on the connections between the very young and the very old, the unfinished or yet-to-be, and the rich history of having been.

This piece is a combination of traditional oil on canvas with a digital, mechanically driven kinetic sculpture. It represents a fusion of technology and art that allows us to display information in a meaningful and beautiful fashion.

The overall display is created by the interaction of four woven panels, each of which can be moved independently. Each panel contains five 10x10 inch "pixels" (e.g. five female heads). When visible, a pixel makes up one quarter of a complete image. The strips are moved mechanically in order to reveal any individual pixel, or portions of two adjoining pixels, with the potential to create hundreds of images.

ARTWORK AS DISPLAY
Artwork is created to convey a message. Because we can control which image is shown using a computer, we can choose to vary the image and therefore the message.

By changing the images displayed, ideally when no one is in the same room, the piece calls attention to itself, providing a subtle reminder or perhaps conveying one of five messages.

1. This artwork was created by Jennifer Mankoff.

FIGURE 1: A series of 5 images consisting of 4, 10x10 inch "pixels"

FIGURE 2: A mis-aligned image

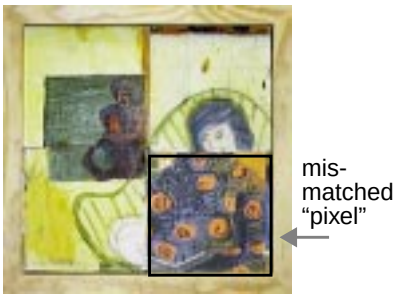

FIGURE 3: A mis-matched image

FIGURE 4: More dissonance

Because of the dynamic nature of this display, it can convey information that goes beyond the original series of images designed by the artist. There are two distinct ways in which the computer can affect the user's viewing experience.

First, a pixel can be mis-aligned such that parts of two different pixels are both visible at once (see Figure 2). Second, a pixel can be mis-matched (see Figure 3). Here, pixels from different coherent images are shown (such as the head of the child with the body of the older woman). In either of these cases, the user tends to experience a sense of *dissonance*. The strength of that reaction is related to the number of pixels which are mis-aligned or mis-matched (compare Figure 2 to Figure 4). Dissonance can be used to indicate, for example, that there has been a significant change in the information driving the display.

TECHNOLOGY

Each of the four "pixels" is painted on its own canvas panel alongside four other versions of the same pixel. These canvas panels are looped and connected end-to-end to form a belt, and are placed on the mechanical frame over a pair of rollers (See Figures 5 & 6). One roller drives the movement of the belt, the other is a spring-tensioned idler that keeps the belt taut. Alignment of the belts is maintained by means of physical guides. The drive roller is itself connected to an inboard mounted, uniphase stepper motor by a belt.

CONCLUSIONS & FUTURE WORK

As described in [1], the mechanics of ambient displays are difficult to design and this effort was no exception. In our case, the inexact nature of the painted panels led to problems with registration. We plan to mount the strips on carefully cut backings. Additionally, we will add wires between each pixel. Contact between these wires and wires mounted on the frame will signal registration.

We want to incorporate motion as an active ingredient in the display. We are currently creating continuous, un-pixelated panels that are well-suited for using motion to convey meaning. For example, the display can "pulse" by moving the panels back and forth in sync. It can also "flow" by moving one or more panels in a constant direction. We built the mechanism so that the panels can be easily replaced with new panels.

FIGURE 5: A picture of the display next to a hat rack.

The display can also make the transition from ambient to interactive in several ways. First, by increasing the number of "pixels" from 4 to 16, we can display letters, charts and symbols. We built our mechanical system with this scaling in mind. Second, by mounting an LCD display inside the frame and cutting out a portion of the panel, the display can "open up," transforming into an interactive picture.

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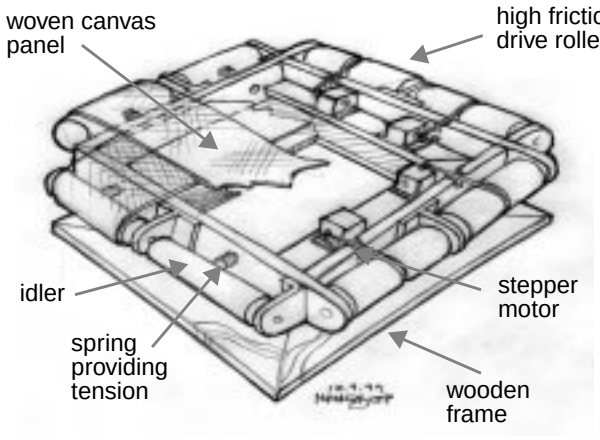

FIGURE 6: A sketch of the device as seen from behind