The Challenge of Maintaining Interest in a Large-Scale Public Floor Display

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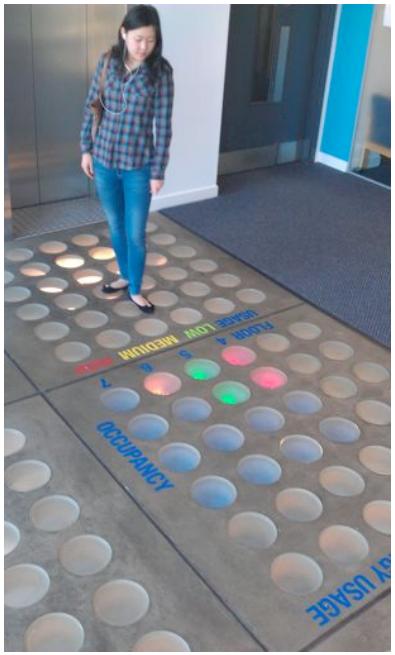

Figure 1. A student attending to the floor display visualizing energy usage and occupancy in the computer science department, UCL, UK.

Abstract
Floor displays, because of the novelty of their location, can be more effective at grabbing the attention of passersby than public wall mounted screens. However, a concern is that as floor displays become more familiar, people will take less notice of them. We are exploring how to maintain interest in a large-scale interactive floor display in a semi-public university location. Our ongoing research involves exploring ways to enable participants to update the content of the display and seeing how effectively this keeps them interested. Firstly, we are making the floor display interactive so that participants can manipulate the content in real-time using whole body interaction. Secondly, we are encouraging the local community to generate content for the display.

Author Keywords
Floor displays; novelty effect; community engagement.

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ACM Classification Keywords
H.5.m. Information interfaces and presentation

Introduction
People tend to ignore public screens [3], and when interviewed they explain their 'display blindness' by saying that they expected the displays to contain irrelevant content, such as advertisements [4]. Shah [7] carried out an observation of a public display showing a Reuters information feed in the foyer of the UCL computer science department (Figure 2) and found similar results: 74% of the people entering the building did not look at the display; 15% glanced at it for up to 2 seconds; and only 11% read the display for more than 2 seconds. In interviews people explained that they ignored the screen as the content did not interest them and that they would prefer departmental information rather than international news.

We hypothesised that using floor displays can be an effective way of capturing the attention of passersby in public spaces and may reduce 'display blindness' [6]. We argued that this is because: firstly, floors are an underused display medium and displays on this surface grab attention due to their novelty; and secondly, people do not have expectations about what information floor displays will contain. Consequently, we hypothesised that a floor display will increase people's awareness of the information it displays. These hypotheses were tested by creating and evaluating an LED floor display that provided information about

Figure 2. The large public screen in the foyer of UCL computer science department.

Figure 3. Anamorphic speed bumps in Philadelphia, USA.

energy usage and occupancy of the different floors of the UCL computer science department. Over several days of observations, it was found that over 40% of passersby ignored it; 39% glanced at it for less than 2 seconds; and 21% looked at it for more than 2 seconds. On average people read the display for 26 seconds. The floor display was positioned near to two lifts (Figures 1, 4) and a demonstration of how engaging it could be was observing several people miss their lift because they were looking at the display. These results support our first hypothesis, namely, floor displays can capture the attention of passersby. Our second hypothesis was supported by the findings from questionnaires (n=20) that showed that 90% of respondents thought that the display had made them more aware of energy usage in the department. Finally, a new result, not previously noted in the public display literature, is that the way people engaged with the display was dependent on the time of day: first thing in the morning, the display was typically ignored (perhaps because this is a very busy time for staff and students, or because they arrive with a specific purpose).

Although the floor display was engaging over the short evaluation period of the energy usage visualization, a worry is that as people become more familiar with it they will pay less attention to the content it is displaying. An example of this habituation effect is the use of anamorphic speed bumps in Philadelphia (Figure 3), which look like 3D structures to approaching drivers even though they are flat pieces of plastic that are burned into the street. Initially, drivers slow down when they see the 'bumps' but the effect quickly wears off. Martin Pietrucha, an associate professor of civil engineering at Pennsylvania State University, commented on this finding: *"We call it the novelty factor…They may get some mileage out of it until people realize, 'Hey, I don't get jiggled like with a real speed hump.' "* [2]. How can we counter short term novelty effects and maintain interest in a floor display? This is a research challenge that applies to all forms of public display. Our approach involves exploring ways of enabling participants to update the content of the display and seeing how effectively this keeps them interested.

Enabling Whole Body Interaction

We are installing sensors so that the floor display will be responsive to whole body interactions. People moving in the foyer area will be tracked by four Thermitrack thermal imaging cameras (http://www.thermitrack.com/) attached to the ceiling. These cameras will allow us to robustly track multiple participants as they are not affected by changes in ambient lighting. We are going to test the hypothesis that interactivity maintains interest in a floor displays in a long-term behaviour change project, *FloorPlay*, that aims to encourage physical activity, specifically using the stairs instead of taking the lift in the UCL computer science building. Participants scan their university ID card at custom-built scanners on each floor of the stairwell, earning points for each floor they climb or descend. When they have sufficient points they can play on a large-scale interactive floor surface positioned in the same area as the energy usage display (Figure 1). Recent approaches in interaction design have emphasised the importance of fun in interaction design [Overb]. Encouraging behaviour change through playful interventions has shown significant promise [6]. Thus, one of the goals of this project is to leverage the motivational properties of games [1] to engage members of the university community.

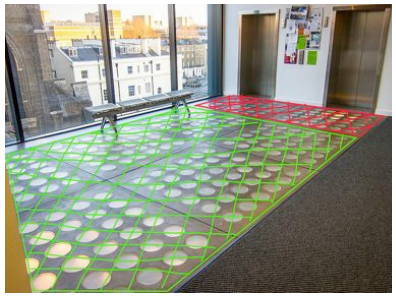

Figure 4. FloorPlay consists of the 216 light wells represented by the green shaded area.

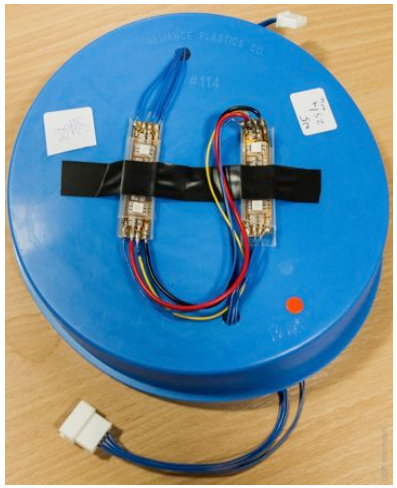

Figure 5. Custom light unit consisting of 4 RGB LEDs attached to a plastic bung.

The foyer floor comprises 288 light wells set in concrete (Figure 4). Whereas the energy usage display consisted of 16 light wells, the interactive floor uses 216 of these wells. Each contains a custom light unit (Figure 5) consisting of four RGB LEDs cut from an LPD8806 LED strip, joined together and mounted onto a plastic cap which fits neatly into the concrete surface from the floor below. The light units are connected in series, with three modified ATX power supplies providing power. An Arduino microcontroller connected to a Mac running Processing code is used to control the floor display. We are able to individually set each of the light units to one of over 2 million colours and update the whole array at a rate of over 25fps- effectively turning the floor into a large display with a resolution of 12x18 pixels.

We conducted a Wizard of Oz evaluation of two interactive games, where participant movements on the surface were manually tracked by the researchers. The two games evaluated were: a version of Pong where a single player's movements control a paddle in order to bounce a puck against the wall, and *CatNipFun* a game where one or more participants chase a moving light on the floor. If they reach the lit LED unit within 3 seconds the light moves to another position, otherwise the game ends. The two games demanded quite different physical interaction on the surface, the first requiring fairly moderate movements across one side of the floor and the other requiring much faster and larger movements. 20 participants from the university, a mix of staff and students, tried out both games. The majority found *CatNipFun* more engaging and they enjoyed the greater amount of physical activity the game required, often continuing to play until they were out of breath. Other participants showed a strong preference for interactions that required relatively little physical activity. Some participants felt too self-conscious to participate on the floor display in public. One said he would have been happy with a 'Kinect-like' interaction, where he would be able to make smaller body movements, such as moving his arms or leaning from side to side. In summary, many people found even simple games engaging and enjoyable because of the novel, large-scale nature of the floor display. Most participants were not inhibited by the public nature of the interactions, but there were clear individual differences regarding the preferred game.

Engaging the Community

Although making the surface interactive enables participants to change the display in real-time and potentially prolongs its novelty, the underlying content, whether games or information visualizations, does not change. We are therefore engaging the community in the building and encouraging them to help generate content for the floor display.

Participants in the Wizard of Oz study came up with a number of ideas for floor display games, such as an 'Etch-a-Sketch' system where their movements would draw images, and an implementation of 'Twister' where groups of players have to move their hands and feet to lights with randomly chosen colours. Many participants suggested that the Pong game would have been improved with a greater sense of competition with their peers which would involve having some sort of scoreboard displayed.

We are starting to engage with an HCI Student Special Interest Group (SSIG), which currently boasts almost 70 undergraduate and graduate student members from the UCL engineering and computer science

departments. This group of students have programming skills and so they can not only generate ideas but also develop new content for the floor display. To facilitate this process, all of the code and hardware for the floor display is open source and freely available to the community. The floor display can be controlled using XML [8] and we intend to make a user friendly interface that enables non-programmers to generate content for the display.

Summary

Public display screens are often ignored by passersby whereas floor displays, because of the novelty of their location, can capture the attention of the public. One research challenge that we are addressing is how to maintain the interest in floor displays, as there is evidence that people can habituate to them. Our proposed solution is to enable participants to update the content of the floor displays. Firstly, we are making the floor display interactive so that participants can manipulate the content in real-time using whole body interaction. Secondly, we are encouraging the local community to generate content for the display. Our long-term behaviour change project will enable us to see how effectively these techniques maintain public interest in the floor display.

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