Your M.O.M (Monitoring Online Movement)

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ABSTRACT
This paper will describe the research supporting the design and development of an ambient peripheral display for web browsing activity. This device seeks to increase user awareness of online behavior while not actively blocking user's online movement. The designers believe that peripheral displays provide unique output opportunities to address negative user behaviors and provide positive reinforcement for changes in behavior.

Author Keywords
Peripheral displays, ambient awareness, behavior monitoring.

ACM Classification Keywords
H5.m. Information interfaces and presentation. H.5.2 User Interfaces. H.5.m Miscellaneous

General Terms
Design, Experimentation, Human Factors.

INTRODUCTION
One of the driving forces behind technology is to insight positive change in the world, yet some problems are such that technology is not capable of change all on its own. Issues that are birthed because of human decision-making and life are more adequately changed by providing opportunities for humans to alter their behavior rather than simply attempting to apply a technological fix. Much research has been done to support the use of ubiquitous computing systems to act as intervention [1].

As the World Wide Web has become an integral part of current daily life, there has been increasing concern raised over usage issues. There have been services that provide web-browsing blocking to prevent employees or under-aged users from accessing sites that are inappropriate. So large companies will block certain social networking sites because there is a pervasive sentiment that having access to these sites will reduce productivity. Similarly, there is the ever-growing discussion about Internet addiction and the social problems that have been attributed to individuals' inability to disconnect from their Internet activities. Because it is unrealistic to simply live without the Internet, and because monitoring usage is becoming an increasingly important commodity, we sought to design a tangible user interface that could address these needs.

While we acknowledge the validity of simply blocking access to certain Internet content for minors, we identified that this does not support behavior modification and awareness for adult users. For this reason we choose to design our interface specifically for adult users.

Awareness can be characterized as "the state of knowing about the environment in which you exist; about your surroundings, and the presence and activities of others" [Rowland & Mynatt]. While our design did not incorporate aspects of monitoring other's activities, we did seek to find tangible ways to display knowledge about ones virtual environment. Through out design we wanted to be able to display information related to a users location on the Internet, and information about how much time a user was spending in specific locations.

When thinking about what kinds of tangible displays could best increase the user awareness and be persuasive in communicating, gathered evidence from other related research studies and found that "over the years, scientists have aimed to make machines that are intelligent and that help people be intelligent. However, they have almost completely ignored the role of emotion in intelligence, leading to an imbalance where emotions are almost always ignored" [8]. Picard indicates in an earlier article that "machines can fake the appearance of an emotion quite well, without having any feelings similar to those we would have" [9]. This work on understanding the affective influence that programming can have on a human user mostly informed the development of Graphic User Interfaces, GUI's, yet there is evidence to imply that the same characteristics are true when thinking about Tangible displays [2].

DESIGN PROCESS / IMPLEMENTATION
The first step in our design process was to create a software plugin that could be added to the users web browsing application. This program can monitor the current web address that the user is at, and monitor the length of time that the user spends at that address.

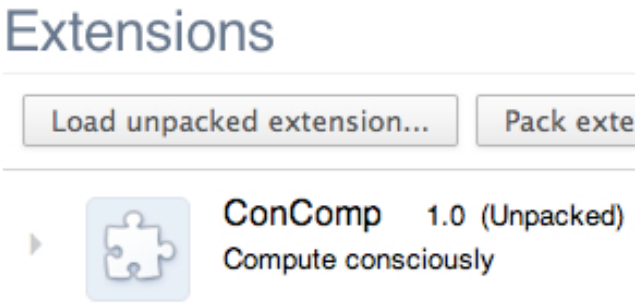

Figure 1. Chrome browser activity monitoring extension.

The design concept is that each user would predetermine the web addresses that they felt were unproductive and each user can predetermine the length of time that they would be allowed to stay at these addresses. Essentially the users determine the blacklist and the immediacy at which they are reinforced and the feedback is updated.

Our initial design focused on providing feedback to the user through their mouse. We wanted to use electromagnetic fields to create the illusion of friction, making it increasingly more difficult for the user to direct their mouse towards web browsing addresses that are predetermined as unproductive. We determined that this output device limited the scope of potential feedback to the user and did not allow us to incorporate aspects of product design that previous research has identified has effective ways to display peripheral output.

Figure 2. A user interacting with the ambient feedback system that is monitoring the user's online browsing behavior.

In later iterations of our Tangible User Interface we identified the importance of building a display that could encapsulate the follow characteristics.

1. Be a tangible display
2. Incorporate aspects of existing human social cues
3. Be personalizable to the individual user
4. Incorporate multiple modes of feedback

As a rational for the above four bullets, Reeves and Nass write that "human beings are hardwired to respond to cues in the environment, especially to things that seem alive in some way" [10]. When users perceive emotions they respond in emotional ways, therefore understanding social cues that a machine could be giving is important when thinking about how humans will respond [10]. Examples cited in Fogg's research of computing based devices that are designed to elicit human emotional response are the early Tamaguichi, Petz and Pocket Picatchu [10]. These virtual pets were designed to be cared for by humans in ways similar to actual pets, thus eliciting appropriate emotional responses and behaviors. To further understand how Fogg has defined Social Cues see Table 1.

Primary Types of Social Cues

Cue	*Examples*
Physical	Face, eyes, body, movement
Psychological	Preferences, humor, personality, feelings, empathy, "I'm sorry"
Language	Interactive language use, spoken language, language recognition
Social dynamics	Turn taking, cooperation, praise for good work, answering questions, reciprocity
Social roles	Doctor, teammate, opponent, teacher, pet, guide

Table 1. Types of Social Cues

Physical

We decided to focus our Tangible User Display on facial features and movement. Using three servo motors and a system of levers and pulleys, we constructed moving mouth parts and moving eyelids. These allowed us to emulate facial expressions ranging from a frown to a smile, and surprise. To avoid having our display appear scary we picked the iconic yellow happy face as our symbolic artifact.

Psychological

Our design embodied two aspects of what Fogg would refer to as Psychological Social Cue. Our product name was Your M.O.M. (your monitoring online movement). The intentional interpellation of maternal relationship insights particular user interactions. Secondly, "designers can make their technology products more persuasive by making them similar to the target audience. The more that users can identify with the product, the more likely they will be persuaded to change their attitudes or behavior in ways the product suggests" [10]. This notion further justified our use of the iconic yellow smiley face, as our target audience for this small implementation was UC Berkeley students. Because of Berkeley's notorious connection to the hippy social movement, and the connection of the yellow smiley face to this same social movement, we were assured that the audience members would not only be familiar with this reference, but also have some sort of connection to it.

Language

Persuasive praise has been identified as being a powerful component to insight human reactions from technology. In a Stanford study users in one group worked with computers that gave 'authentic' praise, another group worked with

computers giving 'generic' praise and the last group worked on computers giving no feedback. The findings were that users felt better about themselves and about the computers feedback than the group that got no praise. This study indicated that people do not differentiate between a genuine expression of emotion when it comes to praise and reinforcement, but simply getting reinforced is powerful and persuasive [10]. These findings support our design process and ultimate decision to incorporate vocal feedback to the user in the form of audio clips. These clips were either reinforcing and reprimanding depending on the users activity, and only occurred when the user changed web address

Social Dynamics

Social dynamics refers to the implied codes of conduct that exist within a given social context. In the later iterations of our display we added two orange hands and a proximity sensor. When a user leaves their computer to approach the interface, a short message appears from behind the box, thanking the user for taking a break. We purposely reinforced users who felt that they wanted to care for the display, especially if it had been made angry or upset by the users consistently unproductive online activity.

Social Roles

The definition of social roles is an awareness of the relationship between different characters in any given interaction. Mostly this is important to realize when considering the power relations that can be either consciously or unconsciously at work. Our design took intentional advantage of the assumed relationship between the user and his or her mother, by inferring the nagging and reminding quality that can sometimes be associated with maternal roles. During implementation this was reinforced by our audience feedback barring one individual who felt that calling reference to his mother only allowed him to rebel against the system, as he would his mother, and was disturbed by these feelings. His suggestions was rather psychoanalytic in nature as he felt the way to remedy this was to name the external display 'his ego', thus not externalizing the source of awareness but rather taking ownership as two parts of one human whole, the 'id' against the 'ego'. This feedback was helpful and further reinforced our assumption that the display could insight social roles.

DESIGN ITERATION

Inspired by the work of Mathews, T., Dey, A., Mankoff, J., Carter, S., Rattenbury, T. we constructed our peripheral display in keeping with guidelines developed by their research. This work highlights the importance of three key design features: Abstraction, Notification Levels, and Transitions.

Abstraction

This process of abstraction describes how the peripheral display is designed to take incoming raw data and display this without placing extraneous burden on the user. In most cases this requires that the information to be communicated using a secondary and symbolic system [2]. Our design took input information from web browsing activities and created emotional feedback based on a scoring system. Our display also incorporated changes in audio output and color/light output, qualities that are commonly associated with peripheral displays.

Notification Levels

Notification levels are a way of delineating the input's importance. As the importance increases so too should the peripheral display's demand on the user attention. Our design did not initially incorporate aspects of more or less; there was simply a continuum of display emotions [Nakajima]. In the second iteration of the project we incorporated audio output feedback that gave relevant auditory comments in response to web browsing behavior. This feedback is immediate and as such commands the users attention only for an instant.

Transitions

Considerations for how to display transitions outlines the distinction between making something invisible, obvious, and somewhere in between this spectrum. It is important to think about the ways the output displays can show a change without demanding constant attention. The research indicates that slow motion or animations are beneficial approaches. Our design incorporated both of these qualities. Our device slowly transitions through the spectrum of emotions, while also providing instant and short-lived feedback when the user changes web addresses before returning to a seemingly stagnant yet slow moving state.

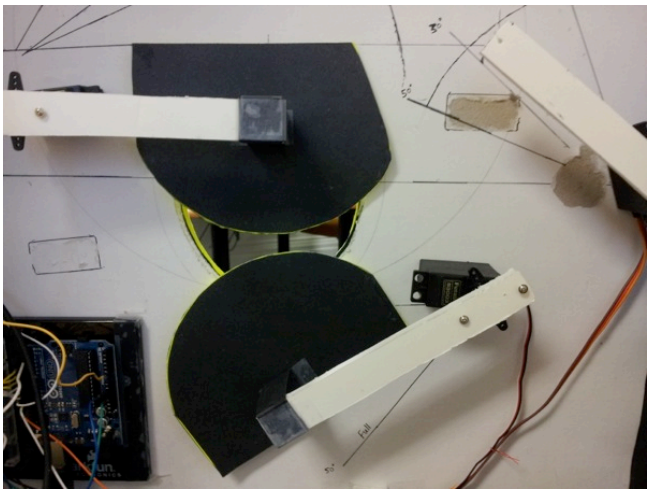

Figure 3. A synchronized arrangement of servo driven parts, gears and a pulley mechanism for eyelids orchestrates the gradual mood and immediate expressions of the system.

RELATED RESEARCH

Research conducted at the Motorola Lab in 2008 utilized ambient feedback as a way to make T.V. watching a more social experience; they called this Ambient Social TV. The work created a constant subtle feedback about their own use and the TV use of friends and family members. This project left off with the conclusion that more research needed to be done to examine how patterns of behavior and perception change as a result of visible awareness of ones habits [Harboe]

Research done at Berkeley explores aspects of ambient feedback in the form of peripheral displays of information from instant messaging systems. The experiment describes a number of tangible and what the research describe as aesthetic displays. Using four output formats this research attempted to display a variety of IM status scenarios by mapping to physical objects that could be placed within a work/home/office space. These tangible displays differentiated whether a single user was present in the chat or whether multiple certain 'buddies' were available; it captured information regarding status updates, and notified the user of messages received [3].

Other designers have done similar research that focuses on the users reactions to the physical objects that were used to indicate the online presence of friends or family member. The hypothesis was that the use of tangible interfaces would promote connectedness. What the preliminary work for this research identified is that people felt that they were the most responsive to augmented objects that contained elements of human presence, for this study that meant augmented picture frames or mirrors [2].

DESIGN EVALUATION / CONCLUSION

The design for ambient emotional feedback that we have build is mostly successful in achieving its objectives. The chief merit of the design is in its practical simplicity and ability to express instantly identifiable human expressions through simple moving parts. The external enclosure designed in the manner of a smiley face is at once recognizable and disarming in appearance to the user. It also imparts a mostly pleasing emotion by default to this ambient device.

In our limit testing in public exhibitions, users instantly connected and responded to both the immediate reactions of the device and also recognized more subtle changes in the overall mood of the device over longer periods of time. The size and public display of the device on the user's desktop makes this system a shared artifact. The greatest effectiveness of the system may be attributed to this fact. The user is conscious that others are observing this system and are to a small extent made aware of how the user is behaving online without knowing the specific websites that the user is browsing. This seems to encourage in the user a motivation for productive online use through a clear and yet agreeable sharing of personal behavior. We cannot offer significant qualitative or quantitative insight into the effectiveness of the design in moderating user's online behavior. However the functional effectiveness and great usability of the device provides opportunities for further studies along these lines.

Figure 4. User interaction demo. The system is expressing surprise in this image.

The device could be improved by implementing additional user input interactions outside of the browser, for instance physical signals to specify if a website is useful or should be blacklisted. Retention of previous emotional states and a model for analyzing and learning based on how the user is using the device would significantly improve the design.

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