Exploring the Power of Feedback Loops in Wearables Computers

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ABSTRACT

Touch, sight, smell, hearing and taste - our senses link us to the outside world. Reflexes react to all stimuli arriving simultaneously to our sensory environment. But there are lapses in awareness of seemingly obvious stimuli to temporary losses of attention and lapses that we are not aware of in the form of reflexes. The main motivation of this research is to plug these lapses with the power of feedback loops in environments where human and wearable computers are intertwined and explore their application as tools for self-modification and sustainable change. This work proposes a combination of body worn objects and hidden technology to create "Singularity" solutions that not only appeal to our senses, but which fuse seamlessly with our everyday lives.

Aristotle (384 BC - 322 BC) is credited with the traditional classification of the five sense organs: sight, smell, taste, touch, and hearing [1]. As far back as the 1760's, the philosopher Immanuel Kant proposed that our knowledge of the outside world depends on our modes of perception [2]. But even if our perception is immediately aware to changes in our environment, our attention to specific targets is limited to the brain's ability to process these stimuli sequentially. Humanistic Intelligence (HI) proposed by Mann [3] describes a framework wherein the natural capabilities of our human body and mind interact in synergy with one another and wearable computers become an integral part of the feedback loop. In this way, human-computer interactions are not separate entities but create a reciprocal relationship between wearer's senses and his second brain, the computer. In order to explore feedback loops in everyday objects, we propose the use of wearable computers that amplifies human reflexes to stimuli and minimizes the use of intrusive devices such as heavy glasses and electromyography. Our interest is to create wearables with hidden technology in "Singularity" objects. Kurzweil introduces the definition of Singularity [4] that is a future period during which the pace of technological change will be so rapid, its impact so deep, that human life will be irreversibly transformed. Our "Singularity" objects include conductive makeup for face motion recognition, black fake eyelashes that are chemically metalized to understand blinking, conductive tattoos for reading bio pulses and jewelry to read the vibration of the voice. Our aim is that the wearer and objects act in synergy in a Humanistic Intelligence framework, amplifying human capabilities. We also investigate the communication possibilities by exposing these stimuli through wearable computers to the wearer and its environment.

Biodata is not expected to predict all future behaviors but it is useful in personnel selection in that it can give an indication of probable future behaviors based on an individual's prior learning history [5]. The power of feedback loops has been used to change human behaviour [6], and it has been explored in the fields of psychology, engineering, economics, social science, systems theory, education, biology, environmental science, control theory, and so forth. But never before in our history have sensors been so readily available. With the cost, size and weight of sensors so low, we can now afford to play and discover the full potential of feedback loops in ways that were previously unthinkable. As technologies become cheaper and more readily available, the potential to embed sensors into the fabric of everyday objects and materials is enabling a form of aesthetic thinking to emerge. By harnessing the power of techno-sensual feedback loops, everyday objects can become reflective tools that stimulate us to modify our behaviours in ways that feel natural and unobtrusive. They may encourage us to play and explore the extended environments that become tangible spaces created in the interface between real-time information and haptic materiality. This advent of novel materials and increasingly evolution of smaller and more affordable electronic components made it possible for anyone to make their own wearable devices. Moreover, people with different skills get together and share their knowledge to create new products. However, they face different barriers such as new terminology, different understandings of technological problems and different creativity processes in each area. This work implements a Blank Model Prototyping method [7] for developing wearable computers in

multidisciplinary teams. This method is implemented collaboratively in the early stages of the developing process and aims to encourage participants to process their ideas and to unleash them in an illuminating step toward understanding what is going to be developed and how it will function.

For exemplifying this exploration, we created Blinklifier [8], a wearable device that senses our reflex of blinking and responds to the specific eye movement patterns of the wearer and amplifies emotions that the wearer wants to communicate by presenting noticeable, exaggerated visual compositions. Conductive makeup and metalized eyelashes were used for amplifying human blinking. In order to avoid using any electronic device on the wearer's face, skin conductive ink [9] was applied as black eyeliner to connect the conductive fake eyelashes to the wearable device. The fake eyelashes were metalized using a chemical process based in two phases: Activation, the fake eyelashes are plastic non-conducting surfaces that were activate through an electrochemical process with tin chloride and silver nitrate and the Electroless phase with Copper for making the eyelashes electrically conductive and black nickel. Blinkifier uses a multiplexing matrix of LEDs to create the blinking patterns in the headpiece and is prototyped using an Arduino microcontroller [10].

Figure 1. Blinklifier, a wearable computer that amplifies human blinking

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