Memory-Rich Clothing

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Abstract
This paper describes a series of reactive body-worn artifacts that display their history of use and communicate physical (or embodied) memory. These electronically enhanced garments strive to promote touch, physical proximity, and human-to-human interaction. We explored distinct input, mapping, and output methodologies that deal with different models of autonomy, memory, and interruption granularity.

The pieces described are part of a larger research project called Memory Rich Clothing. By concentrating on garments that reflect more subtle, playful, or poetic aspects of our identity and history, our enquiry attempts to redefine some of the assumptions that technology designers traditionally make under financial and cultural constraints about how people interact and communicate with each other.

Keywords
Reactive garments, wearable computing, electronic textiles, physical touch.

ACM Classification Keywords
J.9.e Wearable computers and body area networks

Introduction

Computation has infiltrated nearly every aspect of human communication. Personal relationships now span the globe with an immediacy equivalent to talking with someone across the room and take forms as varied as cell phone text messaging, blogging, and shared bookmarks. The proliferation of these "social machines" [3] has allowed people to communicate with each other more quickly and cheaper than ever before. Nonetheless, activities that in the past required people to sit together and interact directly are now mostly conducted through conduits that ignore the physical and social dynamics of how we work and communicate.

Moreover, the miniaturization and reduction in cost of digital memory, input devices, and other digital accessories enable us to capture and store a constantly growing amount of personal data. The more traditional research in wearable technology deals with memory under a framework of efficiency and productivity enhancement. Although these technologies are portable/wearable, they often overlook the presence of the body when registering memories and only capture objective aspects of user experience. [1] [2] This work describes reactive garments that record and display their history of use and communicate physical (or embodied) memory. These electronically enhanced garments strive to promote touch, physical proximity, and human-to-human interaction.

Intimate Memory

The Intimate Memory shirt and skirt employ two different input and output methodologies to record acts of physical intimacy and indicate the time elapsed since those intimacy events have occurred. The first integrates a microphone in the collar and a series of LEDs stitched across the front. When someone whispers into your ear or blows on your neck, the shirt illuminates, showing that an intimacy event has occurred. The number of lights is proportional to the intensity of the event and the time elapsed.

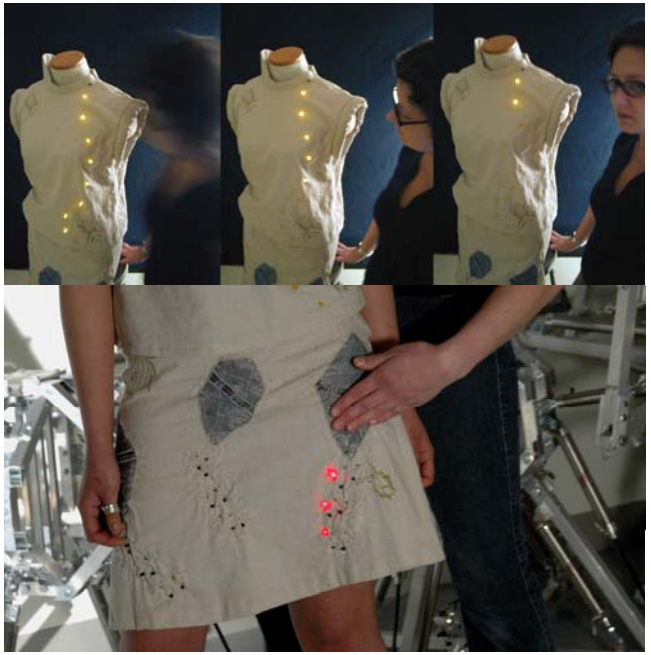

figure 1. Indication of time in the Intimate Memory Shirt. The skirt illuminates when someone touches, or gropes, the leaves.

The second incorporates fabric-based pressure sensors connected with conductive threads to a stitched analog circuit. When they are groped, LEDs illuminate in the embroidery to register the event. In a similar fashion to how our skin registers touch, the illumination fades over time.

Interaction Concept
By focusing on the idea of touch and physical intimacy, this piece deploys a simple model of interaction that has the ability to be quite poetic. The touch and breath are directly mapped to LED displays that portray ways in which our actions and our personal histories can be recorded, stored, and displayed. It highlights questions of surveillance and loss of privacy implicit in the deployment of many wearable technologies.

Constellation

The three Constellation dresses are covered with pairs of magnetic snaps connected with conductive thread. One pair functions as a switch for an embroidered LED circuit. When it connects with the snaps from another garment, the circuit is closed and the LEDs illuminate. The magnetic snaps act as a mechanical and electrical connection between bodies, and their irregular placement instigates wearers to create playful and compelling choreographies to connect their circuits.

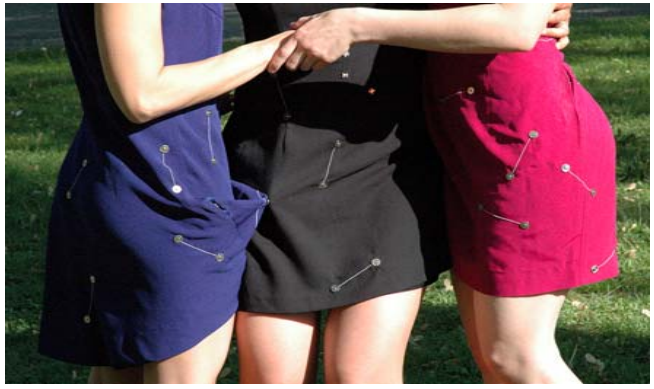

figure 2. Constellation dresses promote touch and physical contact through simple electronic circuits.

Interaction Concept
The awkward placement of some of the snaps forces wearers to contort and exert their bodies in order to connect to one another. This breaks down social inhibitions, merging input with communication, while providing playful feedback for physical exchange. The garments explore metaphors for building electronic or social networks. In addition, they suggest the need to physically connect in order to power oneself, which resonates on both a social level and an ecological level.

Octopus: body-worn interactive modules

While the previous garments allowed explorations of intimacy and interactivity, their physical configuration was fixed, as components were embroidered, stitched, or woven directly into the garments. To allow more flexibility in our investigations, we developed the "Octopus" modules together with Blackdust Design.

The Octopus modules are compact, body-worn displays that support a range of possible interactions. Several devices – approx. 5 to 15 – are intended to be affixed to a single person, using magnetic snaps that can be attached and rearranged on a reconfigurable garment substrate. Each palm-sized device has a flash-programmable microcontroller and a 20-LED display. Each has its own rechargeable battery, so the garment need not carry power or data wires. The devices can communicate with each other and can detect movement of the wearer.

Interaction Concept
Three types of events can be sensed using the Octopus modules. *Body movement* – an accelerometer detects shaking and tilting; thus simple changes in posture or gait can be detected. *Contact* – a capacitive sensor and

an IR reflectance sensor detect the contact of hands or objects with the front surface. *Communications* – the devices can interact over line-of-sight using an IR remote control protocol. Since it is relatively easy to reprogram the modules to study different sensing, mapping and output methodologies, the Octopus provide a modular, reconfigurable, and fully programmable platform for experimenting with body based communication and interaction.

figure 3. Octopus modules distributed on the body and representation of motion and acceleration.

Some of the possibilities that we explored include: “suntanning” (portraying exposure to IR beacons or to incandescent lamps); “viral infection” (visualizing transmission of a code between parts of the body and between people); “body usage history” (display which parts of the body have been moved or touched recently); and, “movement representation” (visualizing the movement and acceleration of the body over time and through space).

Conclusion

By recording and visualizing the “history of use” of garments and the bodies that inhabit them, we create garments that show personal data, such as how they move through space or where and when they have last been touched. These representations reflect more abstract, subtle, and possibly more poetic aspects of our identity and our history.

Acknowledgments

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