The Intuitive Jacket: Creating A Wearable Interface Acknowledging the Role of the Body in Trauma Mental Health

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ABSTRACT

We present a novel, wearable interface as an investigative tool for digital mental healthcare. Immersive environments for therapeutic interventions can potentially involve the whole body of the user in the experience, but often the interaction is through handheld controllers or virtual buttons. Building on suggestions in a previous study from users of an immersive environment for trauma mental healthcare, we developed a new interface, The Intuitive Jacket, to offer control and personalization to the therapeutic process. Our design consists of a physical jacket, allowing users to perform an emotionally powerful interaction: By touching the region of their heart at the end of the session, they “close the door” to the trauma they have been processing. The jacket contains a conductive thread sensor that communicates the garment wearer’s gesture to the software via Bluetooth. It was created via a multidisciplinary collaboration between HCI, Fashion Design and Electronics.

CCS CONCEPTS

• Applied computing → Life and medical sciences; Health care information systems; • Human-centered computing → Human computer interaction (HCI); Interaction paradigms; Virtual reality; Ubiquitous and mobile computing.

KEYWORDS

Wearable Technology, Digital Mental Healthcare, Embodiment, Trauma, Immersive Environments, Investigative Tools

ACM Reference Format:


1 INTRODUCTION

Mental ill health is a growing social problem, affecting an estimated one-tenth of the world’s population. [10] However, conventional therapeutic interventions typically involve a seated conversation and can therefore exclude the role of the human body and interaction with the environment. In a previous study we engaged “Experts by Experience” with lived understanding of trauma, trialling the use of a unique digital therapy called The Timeline. We discovered that participants favour having options to build towards gaining control during the process, where being physically involved in the context of therapies can lead to autonomy. [2] However, currently interactions in virtual environments typically involve either handheld controllers which are more aligned to gaming; or simple gestures such as “virtual buttons” on the wall of an immersive room.

Building on findings from previous work, our research is looking at ways to make digital therapy in immersive environments more involving. Our approach was to develop a novel wearable interface: The Intuitive Jacket. This is a physical jacket with a sensor on the user’s chest, wirelessly triggering an action in the immersive room when it is touched. As the sensor is located over the wearer’s heart, it facilitates a potentially important final action in the therapy session by allowing the user to “close the door on the past” by touching this anatomical region of the body. The jacket was constructed in collaboration with a fashion team and an electronics expert.

2 RELATED WORK

A range of wearable technologies for healthcare have been developed, including electronics that integrate with clothing and accessories and can be worn on the body. Wearable technologies range from the more common smart watch, through to functional smart jackets. [4] A review of wearable technology in medicine showed a potential role for body sensors and head-mounted wearables, but not enough scientific evidence to prove that an application of such technologies improve patient care or satisfaction. [6] A literature survey of 18 studies in wearable technology for patients with depression confirmed that depressive symptoms can be estimated by many parameters collected by a wearable device, and that prediction and diagnosis can be performed remotely. [7] Finally, a questionnaire study with 427 respondents showed that there was interest in wearable technology for treatment of mental health challenges, but that such devices appealed mostly to those with
negative experiences of psychological therapy. [5] Taken together this show promising avenues for wearable technology in mental healthcare, with some researchers describing “wearable therapy” with ability to improve confidence and offer emotional wellness. [12] Our system differs from previous studies in that it integrates the sensing jacket in an immersive environment, where it is used as a direct input to express the participant’s closing a virtual door to their trauma.

3 CREATING THE INTUITIVE JACKET

The design of The Intuitive Jacket followed a human-centered approach. It builds on evaluating the use of a digital mental healthcare intervention in an immersive interactive room and observing and gathering data from participants interacting directly with the technology. [2] A main action at the end of a session was for participants to close down “virtual doors” on their deep past. The original design used a virtual “button” on the wall which the user would touch. We posited whether a person could interact directly with themselves as the interface instead, rather than a button. Based on data from the prior research, we had the idea of using a wearable item as an interface, and The Intuitive Jacket as a concept began taking shape. We decided that by incorporating a hand gesture and a user physically taking part, this could be a powerful way for a user to embody a process of closing down a door on the deep past. Over several weeks this was discussed with the Fashion department at our university, resulting in a series of design decisions. Firstly, we envisioned a jacket with potential to offer users a sense of feeling “safe”, “protected”, “comforted”, “empowered”. The led to a series of ideas to incorporate in the new interface, as described in 3.2. This built on the previous study highlighting participants wanted to feel in control and sense autonomy during their therapeutic intervention; also to have choice in terms of how they interacted. Secondly, one of the simulated features of the original study’s immersive room displayed the Aurora Borealis (Northern Lights) and we discussed transferring the colour swatches from this backdrop and incorporating it into the jacket. Overall, from a viewpoint of a participant in therapy interacting with a wearable technology to elicit a response with the surrounding environment, The Intuitive Jacket provides an arguable middle-ground between person or agent and world. What we postulate here is that the focus be less towards what isolated parts are doing and more how by linking them all together: participant + garment + immersive room – this creates a system and the jacket becomes a tool for investigation. [3]

4 FIRST PROTOTYPE

After deciding on the initial concept for the jacket, we took this to the Electronics department, to determine whether the wearable interface could actually connect to the technology in the immersive room. A mock-up (Figure 1) was created to show how a computer could connect to a sensor on the jacket. We selected a Bare Conductive Touch Board, a microcontroller board based on the Arduino Leonardo to run the main software, along with a Bluetooth adaptor (Figure 2). We created a conductive ink patch (Figure 3) to test where the sensor would join at the shoulder seam, to ensure it came down the front panel of the jacket to meet the Touch Board at the correct point. We then scaled it up and created artwork to produce a screen for screen-printing and printed the outer jacket with the lining and the circuit board. The garment was then embroidered, joining outer and inner conductive print to ensure they connected using conductive thread. After this, press stud was placed at the end points of the conductive circuits to allow the attachment of the Touch Board.

After completing a first prototype, we embroidered a heart to the outer sleeve of the garment to act as a “button” and stitched a conductive thread circuit up the sleeve and down the front panel of the garment to meet the Touch Board, as seen in Figure 4. We then ensured the outer button and inner circuit would join and added an additional stitch to combine these together, with a press-stud
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Figure 4: Jacket with embroidered heart.

to the end of the stitch line. The stitch version consisted of a top
thread of standard cotton and a bottom conductive thread.

We tested the conductivity and found that whilst it worked,
because of the nature of the calico as a standard toile-material
the ink had soaked, where the wearer’s body would have earthed
the circuit and any conductive elements. We therefore covered
the printed circuit with additional calico and an additional panel was
added to the front to stop the ink coming through; shifting the
Touch Board into a side-insert pocket to allow no contact to be
made with the body and front pocket functionality as normal.

As a next step, we created software code to interface with the
immersive room. This was accomplished by detecting when the
conductive ink sensor was touched by a wearer of the garment and
sending a Bluetooth signal to the computer running the software
(see Figure 7). The Bluetooth signal corresponded to the same input
as when touching the wall button to “close the door” in the virtual
room. Thus, when a participant touched the heart region of the
jacket at the end of the session, the virtual door would close as
intended.

5 HIGH-FIDELITY VERSION

After confirming that the interaction worked as anticipated, we
developed a high-fidelity version of the garment. The initial require-
ment for it to feel “safe”, “protective”, “comforting” and “empower-
ing” led the fashion technician to decide on a bomber-style jacket,
due mainly to its compact shape. We were further inspired to design
something somehow organic in appearance to match the appeal of
the immersive room’s Aurora Borealis and we also decided that a
heart motif was too obvious and thus eliminated this feature.

We liaised with a pattern cutter to produce a pattern for an initial
toile to check its fit. We then explored different fabric considerations.
The palette was based on the backdrop visual that played in the im-
mersive room during a therapy session, based on aura borealis, and
therefore we initially sampled blue/green. After further research it
was agreed that the jacket could also benefit from a tactile surface.
We produced initial samples to include embellished fabric textures
to incorporate soft switches by needle punching conductive fibres.
Further discussion around the how the garment would provide
a sense of protection led to employing quilting techniques. The
design aspect of the quilting structure was informed by hexagonal
anatomic makeup of cortisol hormones present in trauma, subtly
reflecting the mental health aspect of the jacket. Using Adobe Illus-
trator we produced several designs with one selected. Furthermore,
several colour scales where sampled and agreed upon. The final
fabric was selected based on its reflective qualities, reminiscent of
the aura borealis visuals in the immersive room projections.

Instead of ink, the sensor for the interactive gesture was created
using conductive thread on the spool as part of the quilted design,
creating a more fluid experience when gesturing. For the final
garment, the lining was stitched into the garment before closing
the lining, and conductive thread was used in the spool case to
create the switch. Overall, this was created by top stitching through
the outer garment and inner lining to connect both layers - thus
completing the circuit.

Figure 4 hints at the dedicated hours of stitching that went in to
create the jacket. Figure 6 shows where the Touch Board is placed
for easy access and removal within an inside pocket. Finally, Figure
7 shows a preliminary user trial with one participant. Importantly,
the finished jacket resembles a finished, high-quality garment, with
the reflective fabric adding a sense of style and mystique that makes
it attractive in its own right, not just another computer component.

6 CONCLUSIONS AND FUTURE WORK

The current jacket is functional but has so far only been tested infor-
mally in the immersive room, receiving positive feedback. The next
step is to conduct a user study with people who have experienced
trauma to determine if the interaction improves their experience
of the process. The Intuitive Jacket has potential to act as an inves-
tigative tool and facilitate a new form of wearable technology in
a context of mental healthcare. In the future, this kind of design
has potential to take personalization and autonomy to an enhanced
level in digital health services. An interface such as The Intuitive
Figure 7: A participant wearing the jacket in the immersive room, showing the bomber jacket style and fabric reflecting the aurora borealis motif.

The Intuitive Jacket might then become more than just a wearable device, offering people whose physiological selves have been impacted by trauma an opportunity to incorporate the body in an empowering way. What also emerges from this work are fresh ways to conceptualize users, less as isolated individuals as passive receivers of digitized experiences, recognizable instead as active, embodied agents who are intrinsically connected, as part wired to a system.

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