



SCAH!RF: A Novel Wearable as a Subconscious Approach for Mitigating Anxiety Symptoms

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Abstract. Mobile and wearable interfaces have long been developed to improve mental health issues, including anxiety disorders, which represent a significant public health problem affecting more than 250 million people. However, most of the current approaches still operate in the so-called “reflective mind”, which hampers results since reflecting on your own health data can induce even more stress and anxiety. In this poster we introduce an alternative approach towards mitigating anxiety symptoms through the use of “subtle” wearable interfaces. Capitalizing on the subconscious processes of the mind is particularly attractive for anxiety disorders. We present a smart wearable in the form of a scarf that implements a subconscious, less-invasive approach in the design of assistive technologies for mental health. Preliminary results bring important implications for interaction design: combining psychological conditioning therapy (via a mobile app) with our smart scarf provides a solution that can be worn anytime anywhere to fight anxiety symptoms. But this work also raises many privacy and ethical concerns which should be discussed by the HCI community: how can designers balance the opaqueness of subconscious approaches with the necessary ethical transparency? And how can mental health technologies be conceived in such a way they do not instigate societal stigma in users?

Keywords: Mental health · Anxiety disorders · Subconscious · Assistive technologies · Wearables · Haptic interfaces

1 Introduction and Background

Anxiety disorders, such as panic disorder and agoraphobia, are a group of mental disorders characterized by moderate to severe feelings of anxiety and fear, which can lead to behavioral change and situational avoidance. Recent studies have shown that more than 250 million people struggle with some form of anxiety disorder, near 15% of which are European [1]. This makes anxiety a public health concern of significant impact. In haptics, there is ample knowledge about the neuroscience aspects of touch [1, 3]. In this poster, we present a novel research direction for Wearables as subtle haptic interfaces aimed at improving mental health and mitigating the symptoms of anxiety disorders. We present the initial prototype for a new wearable (Scah!Rf), under development, which

exploits haptics and classical conditioning as a way to intervene when anxiety symptoms are experienced by the user. The innovation behind our contribution stems from the paired combination of a conditioning phase, when the user is repeatedly exposed to a mobile app user interface. This mobile app aims to shift the user's negative thoughts by replacing a pre-existent negative conditioned stimulus with a positive unconditional one, in the form of an audio clip. This same audio clip is triggered in a smart scarf when the user touches its fabric in a repetitive way, i.e. when anxiety symptoms occur. This approach goes against the dominant narrative of reflective-based approaches, such as cognitive-behavioral therapy, and leverages powerful processes of the neuroscience of touch in a subtle, unconscious way. This is particularly attractive for mental health issues, since the reflective mind - as defined by Kahneman [2] - does not bring solid results for anxiety. Reflecting on your own anxiety data can induce even more anxiety.

Touch is the paramount sense, and the first sensory system developed in animal species [3]. From an early age, touch is an important part of the development of immunological system in both animals and humans, and research suggests this type of stimulation help lower cortisol levels, which in turn can improve quality of life and mental health. In 1958, Harlow and Zimmermann [4] showed how the tactile sense can also impact affection, as their experiment made visible that infant monkeys were drawn to, and sought comfort in softer materials like cloths, opposed to cold, hard materials like wire. Such contact comfort is also a crucial part in the development of perception and emotion on human babies. As the largest, most sensitive sense organ humans have, the skin, when touched, sends information to the somatosensory cortex that allow us to perceive, process, and respond to information we interpret as texture, pressure, temperature, and vibration. This haptic perception is what puts us in direct contact with our surroundings and makes possible for us to explore and recognize attributes such as softness, thickness, and warmth. Although research has been done that proves touch can be a powerful and universal means of communicating emotion [5, 6] the majority of interfaces developed in this area still focus on haptics as a channel to deliver information - in an unobtrusive manner - to users, or to mediate social interactions, with much disregard on the potential of employing embodied cognition and incidental touch principles [7] into the design of haptic interfaces, making them a subtler, unconscious approach to help mitigate anxiety symptoms.

2 Wearables as Subtle Interfaces for Improving Mental Health

When discussing about mental health, the form-factor plays an important role in the success or failure of wearable devices. Several wearable interfaces have been developed that capitalize on the unobtrusiveness, familiarity, and social acceptance of designing garments embedded with technology. Lightwear [8], for example, takes advantage of this approach and presents an alternative to light boxes, the predominant yet outdated method of treatment for Seasonal Affective Disorder, which no longer constrains users to a sitting position nor requires them to learn new skills in order to operate and interact with such objects. However, we performed a systematic review of the literature ($N = 1108$ papers), outside the scope of this poster, and found there is still

a lack of truly non-intrusive, wearable assistive technologies. Most wearables are just used for sensing purposes, and cannot be used in social settings, as they would draw unwanted attention to individuals who may already feel self-conscious.

Our approach combines a conditioning therapy phase during which the user is exposed explicitly and repeatedly (at the end of everyday) to a mobile app that invites the user to perform a 50-s deep breathing exercise, after which a positive reinforcement is provided, in the form of an audio clip. This same audio clip is triggered in a smart scarf when the user touches its fabric in a repetitive way, i.e. when anxiety symptoms occur. The exposure effect from the conditioning phase, coupled with the audio positive reinforcement signal, can then be reproduced via a mini-speaker embedded in the fabric of the scarf. Hence we present two separate interfaces that share the same affordances and help individuals cope with stressful situations by using a subliminal approach, where the physical manipulation of the wearable is unconsciously associated with a relaxed state of mind through a previous conditioning phase. Figure 1 illustrates both the wearable and the app's user interface.

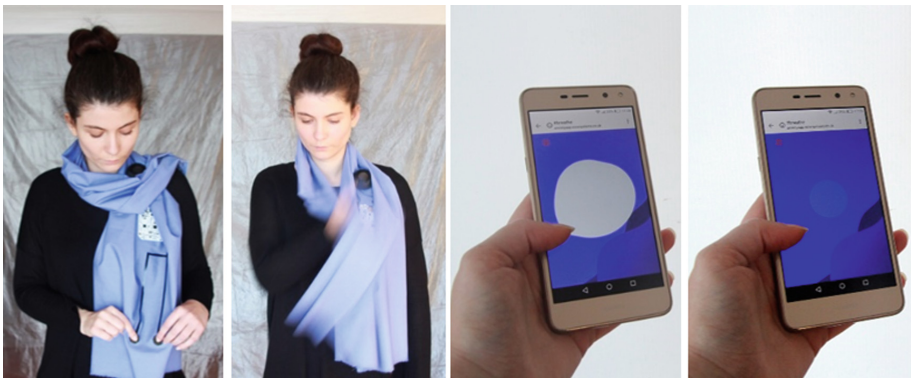


Fig. 1. Scahlrf's prototype, embedded into a scarf using conductive ink and a mini-speaker (left). The mobile app used for conditioning through a 50-s breathing exercise (right).

The smart wearable prototype was developed using conductive ink and a touch board by Bare Conductive. The mobile app was designed to be platform-independent and works both in Android and iOS devices. A breathing exercise was selected, as it is currently one of the mainstream methods for dealing with anxiety available at Google Play and the App Store. The app also acts as a logging tool and surveys the users regarding their mental well-being, which will be used in an extensive, six-month long evaluation of the prototypes that is being performed with anxiety-suffering voluntary participants. We currently conducted informal observations, interviews (with patients and therapists) and qualitative analysis of the results.

As smart textile technologies evolve further, one can expect smaller and softer sensors and actuators to become mainstream. Future work includes further evaluation of wearable interfaces operating at a subconscious level, capable of improving mental well-being without the need for constant self-monitoring or overloading users with access to unnecessary health-related information.

3 Discussion and Conclusion

Anxiety disorders affect a significant part of today's society. Current wearable technologies hold the key to bringing more effective digital interventions. These will always be limited and it is not our focus to replace therapists, psychologists or drug-based approaches to mitigating the symptoms. Instead, we explore the design space of wearable technology to address this problem and focus on discovering new approaches based on the subconscious processes of the human mind. Our results are preliminary, and are based on qualitative analysis, observation and interviews performed throughout the iterations of the wearable, from its initial concept to its current form. They suggest two main design implications: (i) subtle, non-intrusive approaches for mitigating anxiety symptoms are much harder to conceive than the approaches based on the reflective mind – to achieve solid results, the exposure period must be extensive (i.e. more than just a few weeks); (ii) combining psychological conditioning therapy (via a mobile app) with our smart scarf provides a solution that can be worn anytime anywhere to fight anxiety symptoms. The subtlety inherent to such solution reduces stigma and brings convenience to users. This haptic-based approach, through a scarf form factor, is less invasive and more portable than many other existing solutions. This is extremely important for anxiety and mental health, since the symptoms can arise at any moment in time and at any place (public or private). This work also raises many privacy and ethical concerns which should be discussed by the HCI community: how can designers balance the opaqueness of subconscious approaches with the necessary ethical transparency? And how can mental health technologies be conceived in such a way they do not instigate societal stigma in users?

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