A Subconscious, Context-Sensitive Approach to Psycho-Physical Well-being

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ABSTRACT
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. We argue that pervasive context-aware computing can play a major role in helping manage and recover from panic attack episodes. The goal of this position paper is to analyze and assess if the state of the art mobile applications do, in fact, contribute to healthier behaviors and mental states, and to propose improvement opportunities where those factors are not met. The results of our study suggest that pervasive systems, such as smart textiles, when paired with context-aware computing, can help people suffering from anxiety disorders, specifically panic attacks and agoraphobia, take back some control and better adapt to stressful situations without having to consciously think about overwhelming amounts of information. The current approaches are mostly based on the so-called “reflective mind”, giving users constant access to detailed health data, which can harm their mental wellbeing, since reflecting on our own health information can induce stress and anxiety.

CCS Concepts
• Human-centered computing → Ubiquitous and mobile devices; • Applied computing → Health care information systems; Health informatics;

Author Keywords
Mental health; anxiety disorders; subconscious approach; subliminal priming; context-aware; mobile applications; pervasive systems; smart textiles.

INTRODUCTION
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. According to World Health Organization’ estimates [10], by 2015, 264 million people were struggling with some form of anxiety disorder, 14% of which were European.

Although these disorders are usually non-fatal, individuals suffering from such conditions often experience symptoms like shortness of breath, chest pain, confusion, and nausea. All these symptoms can also be applied, and thus mistaken, for a heart attack, which only reinforces fear of dying, and several other debilitating feelings, in panic attack sufferers. This is why people who suffer from panic disorders experience persistent anxiety symptoms, which can lead to functional impairment and unhealthy behavioral changes. If such behaviors are prevalent, they can lead to agoraphobia, where individuals fear and actively avoids situations where they feel “escape might be difficult or help might not be available in the event of developing panic-like symptoms” [2].

While many factors can influence the occurrence of this type of disease, and symptoms can differ according to different individuals, we can find a common ground when it comes to external triggers, such as location and weather conditions, that can be monitored with GPS; and physiological symptoms, like increased heart rate, and body temperature, that can be detected through measurements made by wearable devices. Thus, with the help of context-aware systems, it is possible to monitor parameters which are essential to the detection of panic attacks [4].

Nowadays, several health-related mobile applications allow people constant access to their personal health information, which may not be the best approach when we talk about mental health data, since this overwhelming amount of information may cause additional stress and anxiety.

This position paper aims to assess whether existing mobile applications do, in fact, contribute to healthier behaviors and mental states, and to show the existing gaps and shortcomings in such health and wellbeing-related apps. Additionally, we briefly review the state of the art research performed in the field of pervasive smart textiles, an approach that we are pursuing and that is related to this subject.

Finally, this position paper discusses how pervasive systems, such as smart textiles, when paired with context-aware computing, can help individuals suffering from anxiety disorders, specifically panic attacks and agoraphobia, take back some control and better adapt to stressful situations without having to consciously think about overwhelming amounts of personal health information, by using a subliminal (unconscious) approach.

CONTEXT-AWARE COMPUTING
The core idea of context-aware computing is that mobile devices can adapt to different contexts (location, environmental,
social, behavioral, etc.), thus being able to provide the appropriate tools or services to each situation accordingly. As stated in [13], the ultimate goal of context-aware systems is to mimic, as close as possible, the user’s perception about their surrounding world, which can help facilitate the prediction of upcoming behaviors. Therefore, context-aware systems are a crucial part in the development of health-related interfaces, especially those focused on mental health issues, where both physiological (measured by sensors) and external context (location-based, social or environmental triggers) are of extreme importance [11].

With the help of such pervasive systems, it is possible to monitor a person’s heart rate, breathing rate, and heart rate variability, parameters which are essential to the detection of panic attacks [4].

EXISTING HEALTH AND WELLBEING MOBILE APPS

Nowadays, there are numerous health-related mobile apps available which aim to help improve a person’s mental health. A quick search for mental health in the Google Play Store (July 29, 2018) shows almost 250 available apps, and although a significant number of them can help reduce stress levels, they all seem to be somewhat generical, and not specific to individuals who are diagnosed or suffer from anxiety disorders.

Next we present two different examples of existing mobile applications, Flowy Beta and Pacifica – Stress & Anxiety, to discuss how constant access to health information may impact a user’s mental state.

Flowy Beta

Flowy [3] is a game designed to help users control their breathing. Although the decision to play this game is conscious, and the Beta version doesn’t make use of any sensors or breathing monitors, it succeeds in shifting the user’s focus from their anxious mental state to a more manageable task, where it seems breathing in and out pushes a boat forward, and requires users to focus their attention in an action that is not perceived as being related to their mental condition, swiping left and right in order to steer the boat and collect rewards.

Because Flowy unconsciously guides users through deep breathing exercises, while distracting them from their existing anxious thoughts, it is a good example of how mobile applications can help improve a person’s mental state by adopting a subconscious approach.

Pacifica – Stress & Anxiety

Unlike Flowy, Pacifica [1] is a more thought-out, highly customizable app, intended to improve long-term mental health, as it requires users to create an account before entering and setting goals. Some features include a planner, to help user’s keep track of their stress levels and learn more about stress management, and a section with uplifting, motivational content, to help foster positive thoughts.

In view of that, Pacifica can, like most of the available existing apps, help a broader audience, but is not necessarily helpful when dealing with short-term solutions to help user’s cope with anxiety disorders, as it provides too much information to users who are already overwhelmed with their condition to know how to deal with and manage such big amounts of data. Moreover, Pacifica can be considered highly intrusive, as it sends users their weekly progress summary via email.

RELATED WORK

This paper expands on the work of Cruz et al. [4], which proposed that mobile and wearable technologies can help reduce the severity of symptoms of people suffering from panic attacks. These authors showed that, by monitoring an individual’s physiological changes 24/7 with a Zephyr BioPatch™ wearable chest-worn device, it is possible to gather enough data to help predict a panic attack up to one hour before it occurs, thus being able to provide users with ways they can better manage and act on escalating stress-inducing symptoms.

How to Intervene

While having the ability to predict a panic attack can be considered a breakthrough, not being able to intervene at the right time and with the right tools can make this prognostic ineffective. In their work, Cruz et al. [4] proposed a breathing exercise intervention, delivered as a notification to individuals who exhibit panic-related symptoms, in which the graphical interface guides users through relaxation exercises.

Although PanicPal [12], the mobile application developed by the authors of [4], promotes a long-term reduction of stress, like so many other mobile apps available today, unlike most apps, they deliver this call to action at a particularly sensitive time, where the realization a panic episode will occur in the near future can intensify anxiety symptoms and even trigger a panic attack sooner than expected.

Subliminal Priming

As Internet reaches the largest number of people at low costs, it can be useful as a channel to help promote health-related behavioral change [9]. Persuasive technology can then, as previously mentioned, be a possible solution to help individuals experiencing some form of anxiety disorder.

Employing the foundations of Cognitive-behavioral therapy (CBT), subliminal priming, often used in advertising, can prove to be a solution to help shift a person’s unconscious negative thoughts by enabling them to perform manageable tasks seemingly unrelated to their mental state. As research done by Jaśkowski and Verleger [7] shows, a person’s behavior also revolves around information they don’t process consciously.

Because subliminal priming works in a subconscious level, it can work as a supplement to an action or choice task the user may need to perform, from the time variations in physiological data start to become noticeable until a panic attack might occur, in order to reduce stress levels in that time frame.

Smart Textiles

Wearable technology, specifically smart textiles, are effective at conveying information in an unobtrusive way [5, 6]. As studies have shown (see, e.g., [14]), tactile displays and dynamic textile patterns can trigger positive emotional responses that help individuals suffering from anxiety disorders.
and other mental health issues regulate their emotions, while requiring individuals a lesser attention demand than that of visual or auditory stimuli [8].

This strategy, paired with a subliminal approach, can help the design of unobtrusive context-aware fashion, such as clothing and accessories, that are a part of our everyday life.

As the work of Stylios and Chen [14] demonstrated, it is possible to create highly personalized smart fabrics that have been shown to have calming effects on people, through the display of weaker, repeating patterns.

This customizable and discreet way of delivering information to a specific user is of great value when we talk about mental health issues, and a step forward from existing technological anxiety coping mechanisms, specifically in cases where individuals may fear being the focus of attention.

CONCLUSION AND FUTURE WORK
This position paper proposes that smart textiles, embedded with context-aware systems, are an innovative way to help people cope with anxiety disorders and improve their mental state.

Although mobile applications have been a widely accepted coping mechanism, used to educate users about healthier practices, help them keep track of their moods, and provide them with breathing and meditation exercises, most of them are directed to a broader audience and can overwhelm users with exhausting amounts of information, which only increases stress and anxiety.

Because tactile displays and dynamic textile patterns can be personalized and deliver information in an unobtrusive way, we feel they can be a vital part in the delivery of coping strategies to individuals who suffer from anxiety disorders, such as panic attacks and agoraphobia, as they require less attention demand than other types of stimuli.

Finally, prototyping and testing must be done in order to assess if smart textiles can, in fact, be an asset in helping individuals shift away from their unconscious negative thoughts by employing a subliminal approach to the way information is delivered. By asking individuals to focus on something other than their state of mind, we feel this can reduce stress-related symptoms prior to a phase where there is a need for them to take deliberate action to deal with their fears and anxiety.

REFERENCES