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Marketing Analysis of a Positive Technology App for the Self-Management of Psychological Stress

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Abstract. The INTERSTRESS project developed a completely new concept in the treatment of psychological stress: *Interreality*, a concept that combines cognitive behavioral therapy with a hybrid, closed-loop empowering experience bridging real and virtual worlds. This model provides the opportunity for individual citizens to become active participants in their own health and well-being. This article contains the results of the Marketing Trial and analysis of the opinions of individual consumers/end users of the INTERSTRESS product. The specific objective of this study was to evaluate the feasibility, efficacy and user acceptance of a novel mobile-based relaxation training tool in combination with biofeedback exercises and wearable biosensors. Relaxation was aided through immersion in a mobile virtual scenario (a virtual island) featuring pre-recorded audio narratives guiding a series of relaxation exercises. During biofeedback exercises, a wearable biosensor system provided data which directly modified the virtual reality experience in real-time. Thirty-six participants evaluated the product and overall feedback from users was positive, with some variation seen based on participant gender. A larger market study is now underway to understand if there are cultural variations in acceptability of the device.

Keywords. Stress, biofeedback, heart rate, wearable sensors, mobile health, positive technology

Introduction

In spite of the advancements in medical technologies and a general increase in income levels, healthcare continues to pose challenges of affordability, complexity and access across the world. An increasing number of European citizens need access to healthcare. This trend is extremely expensive for national healthcare systems, hence there is a strong need to find new cost-effective solutions to promote the improvement of existing care. To face this global challenge the European Commission realizes that the employment of telemedicine health systems can help to reduce the heavy burden of demand for services. New mobile platforms, as well, can help participants to become active participants in their own health and well-being, thus moving from a disease

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model to a health promotion/disease prevention model of individual responsibility. This can help to achieve the objectives of improved healthcare outcomes and decreased costs; enhanced accessibility to existing services by those who need them most; and igniting of innovative and entrepreneurial activities.

In this framework, the growing problem of chronic stress has become an increasingly important public health concern throughout Europe. Stress-related disorders have been shown to cause and exacerbate physiological and behavioral disturbances ranging from immune system dysfunction to psychiatric disorders [1]. Financial costs of work-related stress in the EU-15 were estimated to be €20 billion per year including accidents, absenteeism, employee turnover, diminished productivity, and direct medical, legal, and insurance costs. [2]

The INTERSTRESS project aimed to address these problems by developing a completely new concept in the treatment of psychological stress: *Interreality*, a concept that combines cognitive behavioural therapy with a hybrid, closed-loop empowering experience bridging real and virtual worlds. This model provides the opportunity for individual citizens to become active participants in their own health and well-being.

1. Methodology

The experimental training was provided through the mobile application "Positive Technology" (http://www.positiveapp.info/) using the iPad and iPhone and with heart rate monitoring devices, Mio Alpha and Empatica.

Prior to the marketing trial, an online survey was created using the using the System Usability Scale. Study equipment was purchased which was followed by the synchronization of the application, mobile and heart rate monitoring devices. A protocol was developed, and staff participated in training and testing prior to beginning the trial.

Participants were guided through every feature on the application and then were encouraged to use the product independently. Heart rates were recorded on a paper form at three different stages: 1. Baseline 2. After several minutes using the app's features 3. After exiting the biofeedback features. Half of the group used the iPhone first and the iPad second and half did the reverse. Each participant was given an information sheet which contained the relevant project information and were required to complete an Informed Consent Form. All data was collected anonymously.

The participant was guided through two types of stress-management exercises:

B*iofeedback:*
The mobile Heart Rate Biofeedback Training is aimed to help users in managing and coping with psychological stress. It consists of a portable heart rate monitor connected via Bluetooth interface with the mobile application.

The heart rate is used to calculate indexes of heart-rate variability (HRV) that are displayed in the form of animated 3D visual feedback to the user: by controlling the respiration rate, variations in the Heart Rate Variability indexes controls the features of the virtual environment, such as the increase or the decrease of the size of a virtual campfire or waterfall. In this way, the user learns to control autonomic responses to stressful situations. Heart rates were recorded during this exercise.

Relaxation technique:
Guided relaxation training is based on the most effective stress management techniques, such as Autogenic training and Progressive Muscle Relaxation. The relaxation training is provided in the form of audio narratives within engaging virtual reality scenarios (i.e. the "relaxation island").

2. Evaluation

The aim of the evaluation was to assess the efficacy and usability of the mobile-based relaxation training tool in combination with biofeedback exercises and a wearable cardiac monitoring sensor. During the study, both subjective (self-report) and objective measures (heart rate) were obtained to help determine if the product was successful at reducing the participant's stress levels. Healthy volunteers, male and female, aged 18 – 65 were recruited through e-mails and flyers in locations in Brussels and Leuven in Belgium. Our sample included an even distribution of genders and a variety of nationalities, ages and levels of education. Post-trial measures included self-reported stress levels and cardiac activity data. In addition, participants were asked to fill in a System Usability Scale (SUS) [3].

Feedback from users was overall quite positive, with the main advantage they saw being the availability and accessibility allowed by a mobile solution. The biofeedback also proved popular among users, successfully decreasing the heart rates of most participants. Users also found the product fun and easy-to-learn, comparing it to playing a game.

The most common response to the product's disadvantages was the cost of the biosensors which many reported to be potentially prohibitively expensive. (This of course is an add-on and our platform can be marketed with this as an option). It was also suggested that if the graphics were improved to be more realistic, a more immersive environment might be achieved. (However, although this was noted, it was also noted that users had a decrease in heart rate, indicating a reduction in physiological arousal, during use.)

Participants felt relatively confident using the system, reporting it was easy to use and straightforward. Some, however, were unsure if they would use the product frequently.

Users reported feeling the system reduced their stress levels, with the average score being 2.91/5.00. This was also seen objectively with the Biofeedback Training and Relaxation Island. Sixty-eight percent of participants had a reduction in heart rate, indicating physiological relaxation and stabilization after only a few minutes of use and instruction. Below in Figure 1, we show the comparison of actual heart rate fluctuations with self-reported stress-level reduction. For this, we have evaluated the percentage change from resting heart rate to heart rate after using the biofeedback feature. There was a low positive correlation of 0.24 for these variables. In training and testing participants and patients over the past 17 years, we have seen that often trainees are unaware of physiological arousal or relaxation when they first come to the clinic. After training sessions, they are able to become aware and self-report becomes synchronous with physiology. So this correlation was similar to population responses from previous studies and would be expected to change as participants became more self-aware.
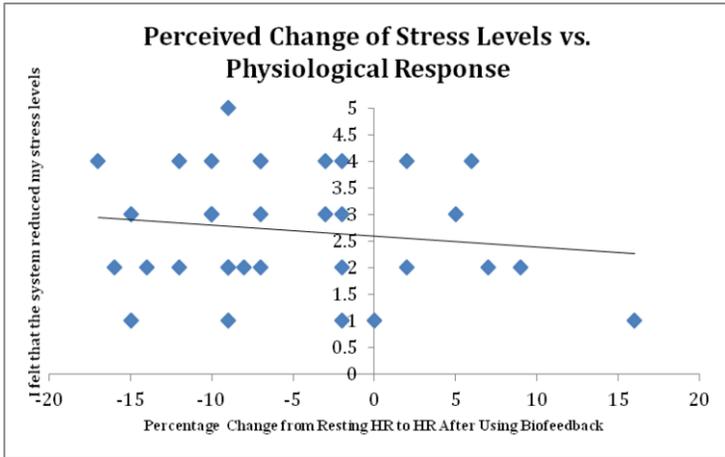
Figure 1. Perceived change of stress levels vs. physiological response.

In the marketing study, we did find some variation amongst groups. Females rated the application more positive overall than did our male participants (as shown in Figure 2 below). There was also some variation among ratings given by those in the different age groups. Participants in the age group 35-44 were the most positive about the product overall, however the youngest age bracket, 18-24, reported that our product reduced their stress levels most significantly.

Figure 2. Male and female ratings of perception of product's effect on stress levels.

A larger market study is now underway to understand if there are cultural variations in acceptability of the device. However, it can be anticipated that feedback from users was overall quite positive, with the main advantage they saw being the availability and accessibility allowed by a mobile solution. The 3D biofeedback also proved popular among users, successfully decreasing the heart rates of most participants.

Conclusion

In this contribution, we described the key features and preliminary evaluation of Positive Technology, a mobile platform for self-management of psychological stress. To our best knowledge, Positive Technology is the first free mobile stress management platform available on the market which provides real-time monitoring of the user for continuous and reliable feedback. A further original feature of this application is the combination of biofeedback and interactive 3D contents, which has not been implemented before on a mobile device. A future goal is to improve the usability of the application and include more advanced stress monitoring features, based on the analysis of heart rate variability indexes.

Acknowledgments

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