Eivind Flobak [1]
eivind.flobak@uib.no
Daniel A. Jensen [2]
Astri J. Lundervold [2]
Tine Nordgreen [3]
Li-Hsuan Chen [1]
Frode Guribye [1,3]

[1] Department of Information Science and Media Studies, University of Bergen
[2] Department of Biological and Medical Psychology, University of Bergen
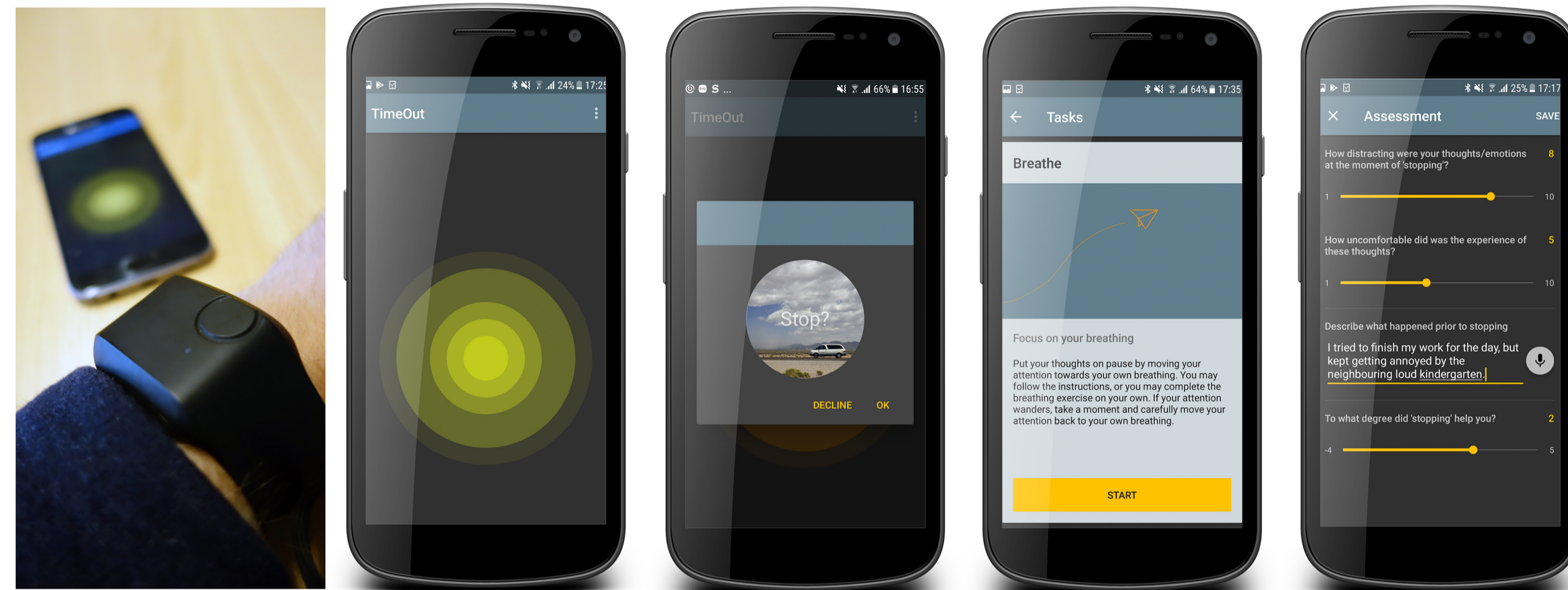[3] Division of Psychiatry, Haukeland University Hospital

Towards Technology-Based Interventions for Improving Emotional and Cognitive Control

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From left to right: Sensor wristband with TimeOut in the background; the main screen showing the continuous visualization of EDA; prompt for intervention; one of five tasks in the behavioral intervention protocol; user assessment of short-term effects.

Abstract

In this paper, we address designing for the delivery of timely cues to initiate skill-building exercises for improving emotional and cognitive control. We focus on adults with ADHD, as they frequently experience difficulties related to such control. The paper describes the design and current user experience evaluation of TimeOut – a skill-building assistive technology to be used by adults with ADHD to improve long-term mastery of self-regulatory abilities. TimeOut, in its current iteration, consists of a wristband monitoring physiological signals, visualization of these signals, an algorithm to prompt interventions, and the delivery of a skill-building exercise on a mobile phone.

Intervention

• How can we design technology-based interventions that support skill-building treatments?

• TimeOut's "stop"-intervention protocol is inspired by Goal Management Training (Levine et al., 2011).

Prompt

• How can we deliver skill-building interventions at the right time?

• Alarm fatigue is a concern for skill-building interventions. Avoiding setting off too many prompts for intervention requires careful design of the algorithm for prompting intervention.

Sense

• TimeOut connects to Empatica E4 through a Bluetooth connection to record physiological signals.

• Electrodermal Activity is used as a proxy for activation.

• A moving average algorithm computes a baseline and filters artifacts from physical activity.

Visualize

• TimeOut visualizes EDA level continously in hues of green, yellow, and red while monitoring the user.

• A field trial (n=6) showed some mixed results: four participants interpreted the colors as a proxy for attention level, although two participants felt distracted by the visualization.

"Stop"-intervention

A task-based stop-technique was designed to be issued if the user accepted a cue for intervention by the system. Five sequential steps are included: (i) Stop what you are doing; (ii) follow an auditory breathing exercise; (iii) reflect on your current situation; (iv) assess and describe the experience you had prior to the intervention and the effects of the intervention; (v) return to the activity you wish to dedicate time to, based on your reflection.

Future work

Some directions for ongoing and further research:
• Improve the sensing algorithm by using HRV, EDA and physical activity sensing to develop predictive models that may increase the accuracy of prompts for intervention.

• Investigate different modes of prompting interventions (i.e., affective sensing, contextual sensing, random signal based on a chosen number of prompts and a probability algorithm, and self-initiation).

• Extensive feasibility study evaluating participants' experience, as well as the treatment's efficaciousness.