Expanding the Research Area of Behavior Change Support Systems

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Abstract. The First International Workshop on Behavior Change Support Systems attracted a great research interest. The selected papers focused on abstraction, implementation and evaluation of Behavior Change Support Systems. The workshop is an evidence of how researchers from around the globe have their own perspective of behavior change interventions. In this abstract, we have attempted to outline core issues that can enhance persuasiveness of such support systems. Finally, we highlight important research questions relating to the development of effective Behavior Change Support Systems.

Keywords: Behavior Change Support Systems, abstraction, implementation, evaluation

1 Introduction

The research field known as Behavior Change Support Systems (BCSSs) is "an object of study within the persuasive technology research field" [1, 2]. A BCSS is defined as "a socio-technical information system with psychological and behavioral outcomes designed to form, alter or reinforce attitudes, behaviors or an act of complying without using coercion or deception" [3]. A BCSS highlights three possible intended outcomes in terms of behavior change:

1. A change in *compliance*, for example triggers can lead to a change in conforming with a certain routine, for example, medication intake;
2. An enduring change in *behavior*; and
3. A change in *attitude*. It is the most demanding type of change and is a necessity for enduring behavior change. The outcomes of BCSSs are the formation, alteration or reinforcement of the three types of change. [3]

When developing a BCSS, the above-mentioned changes and intended outcomes need to be considered. The Persuasive Systems Design Model (PSDM) [4] has received

significant attention and appreciation over the past years for designing and developing systems with persuasive intent. The model is a mix of carefully crafted postulates and persuasive software features. It is worth noting that the postulates outlined in the PSDM [4] are critical for effectiveness of any given persuasive information system.

The PSDM [4] promotes systematic and categorical evaluation of persuasive information systems. For illustration, it emphasizes on the persuasion context that is carefully addressing the designers' intentions relating to behavior and/or attitude change. Lastly, it lays particular stress on the persuasion strategies i.e. the content and route of the persuasive message being conveyed. In terms of software features, the PSDM [4] categorically outlines four distinct categories. In a nutshell, the software features are aimed to enhance human-computer interaction, social influence, facilitating task completion and improve the credibility of the system for an enduring interaction. The model is a valuable tool for analyzing and evaluating persuasive potential for both web-based and mobile BCSSs [cf. 5].

The PSD model provides a method to examine systematically how persuasive system design elements and the categories are used in current web-based interventions. Also, it is meant to provide ideas and tools to design persuasive web-based interventions. Web-based interventions have received significant attention in the healthcare domain, yet the actual outcomes are generally vague in their description. One of the reasons for this limitation is that the designers of behavior change technologies do not pay explicit attention to the use and user contexts [cf. 4]. Furthermore, the persuasive message and the selected strategies are relatively poorly backed up by psychological theories [6].

Designing and developing BCSSs requires deeply thought out persuasive message, the route, and a mix of well-designed persuasive software features. Often an effective BCSS development process also requires transparent descriptions of persuasive strategies that explicate the intended goals of the BCSSs in terms of behavior change in compliance, actual behavior and/or attitude.

2 Focus and Objective

The main purpose of the workshop is to develop a mutually richer understanding of the emerging research area of BCSSs – as an object of Persuasive Technology. It provides a platform for students, researchers and practitioners to have an overview of behavior change models using BCSSs. The six research and work-in-progress papers highlight the components for developing effective BCSSs to achieve the changes in attitudes, behaviors and/or compliance with new or altered behaviors. The papers present work in progress, frameworks, and models for behavior change.

Practical Examples of Mobile and Social Apps using the Outcome/Change Design Matrix by Langrial, Stibe and Oinas-Kukkonen [7] uses the O/C Matrix [cf. 3] to depict the context of usage and the intended outcomes for the mobile and social web application users, related to changes in attitude, behavior or compliance. It can be used to specify persuasive factors that can be incorporated to support users *during* the

process of changing (forming, altering, reinforcing) to create a more persuasive user experience.

*Human Factors Limiting Consumer Benefit from Decisional Suppor*t by Phillips, Ogeil and Blaszczynski [8], discusses the situation that some people might not benefit from BCSSs because the systems require too much effort. Therefore, the key issue is to take into account the differences in users' backgrounds, personalities, lifestyles and context of usage to develop systems that fit with. In case of disabilities for example, the designer and researchers should identify what kinds of cues and how many cues simultaneously can be utilized to support people during decisions or executions of tasks and what the effects are on workload, stress etc.

Managing Multiple Influences: Self-monitoring and Social Comparison at the Same Time and Context by Rosas, Howard and Gibbs [9] articulates how to deal with stress or pressure generated by these influences. The management of more than one persuasive cue at the same moment is underexposed in research. The paper presents the set-up of laboratory experiments to identify the use of personal strategies to manage multiple influences at the same time and context. The results are relevant to understand how many persuasive factors people can handle to avoid excessive employment of triggers in BCSSs.

Hypothesis evaluation based on ubicomp sensing: moving from researcher to users by Yekeh and Kay [10] argues that emerging pervasive sensing technologies can help improve healthy living. In most cases what guides the design is the researchers' own hypotheses about how the systems can work. The key message of this paper is that end-users define personal health objectives based on their beliefs. Emergent technologies can support people to improve their health through self-monitoring systems that collect personal data they can use to achieve their goals. The paper demonstrates a stepwise ubicomp sensing architecture to develop user-models and personal hypotheses for long-term goals. This approach is important to understand how users think about quantified self-tools and how they want to deal with self-tracking data.

Peacox-Persuasive Advisor for CO2-Reducing Cross-model Trip Planning by Schrammel, Busch and Tscheligi [11], discusses a personalized multimodal navigation tool that helps people to drive ecological friendlier. The Peacox system uses persuasive factors targeted at reinforcing desirable behavior. It focuses on emotionally positive aspects rather than restrictive approaches. The paper presents the development of the Peacox System concept, trying to find a delicate balance between the employment of persuasive strategies, as well as the characteristics of different user groups, personalities and travel contexts.

Two actors: Providers and Consumers inform the Design of an Ambient Energy Saving Display with Persuasive Strategies by Kluckner, Weiss, Sundström and Tscheligi [12], highlights ambient persuasive displays as a potential way to raise awareness and lower energy consumption. The authors argue that two views need to be taken into account in their development; the energy-expert and potential users. The paper shows how expert interviews and user-centered design workshop were conducted to define requirements for energy saving ambient displays. The interviews and workshops are aimed at getting data about the content and the feedback system and to find the right combination of persuasive strategies.

3 Discussion

The selected papers provide valuable input for the BCSSs workshop and an occasion for researchers and practitioners to discuss the key issues for developing BCSSs. The identified key issues are:

- The involvement of users in early stages of the development to tailor systems in accord with user profiles.
- Stakeholders' perspectives (users and experts) to create BCSSs that have value in practice.
- Persuasive strategies that are related to different stages in achieving outcomes (attitude, behavior, compliance).
- User profiles to identify what persuasive strategies matter most for whom.
- Usage data to know the dose, duration, time and format of persuasive strategies.
- Combinations of persuasive strategies; how many cues can people handle at the same time? What are the effects of multiple cues?

Based on the contributions, the research questions ripe for studying includes the following:

- adequate design for measuring the effect of persuasive strategies on task adherence during usage and long-term effects (MOST-design);
- frameworks and methodologies to measure attitude, behavior and/or compliance;
- profiling, personalities with persuasive tools;
- multimodal cues and the effects on adherence and outcomes;
- persuasive prompts to create engagement;
- advanced analytics to predict adherence, to identify usage patterns and the effects on adherence;
- persuasiveness of different BCSSs (mobile, ubiquitous, ambient technologies)

Acknowledgements

We appreciate Carl Brandt (University of Southern Denmark, Denmark), Catherine Burns (University of Waterloo & National Institute of Health Informatics, Canada), Dominic Convey (University of Vancouver & National Institute of Health Informatics, Canada), David Ebert (Phillips University Marburg, Germany & Leuphana University Lüneburg, Germany), Shirley Fenton (University of Waterloo & National Institute of Health Informatics, Canada), Petr Slovak (Vienna University of Technology, Austria), Saskia Kelders (University of Twente, the Netherlands), Hans Ossebaard (National Institute for Public Health and Environment, the Netherlands), Heleen Riper (VU University Amsterdam, the Netherlands) and Terje Solvoll (University of Tromsø, Norway) for their effort in reviewing an providing valuable feedback. We also wish to thank Liisa Kuonanoja (University of Oulu, Finland) for her administrative assistance in compiling the proceedings.

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First International Workshop on Behavior Change Support Systems (BCSS 2013)