# From Smartphone Zombies to Natural Language Processing – Designing and Evaluating Behavior Change Support Systems

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**Abstract**. The Eighth International Workshop on Behavior Change Support Systems was held as a virtual event due to the CoVid19 crisis. Despite of the challenging situation, researchers from around the globe joined together to discuss recent advances in Behavior Change Support Systems research. A wide variety of topics was presented from multiple perspectives. The selected papers can be separated to three themes: design and development; user and stakeholder involvement; and evaluation of Behavior Change Support Systems.

**Keywords**: behavior change support systems; BCSS; persuasive design.

## 1 Introduction

Behavior Change Support Systems (BCSS) workshop builds around the concept of systems that are specifically designed to support and help behavior change in groups or individuals. The forefront of this workshop from the very beginning has been the highly multi-disciplinary nature of designing and implementing behavior change strategies and systems. It is a forum for experts from multiple disciplines, where they can present their work and discuss the faced challenges in the realm of behavior change. The workshop provides a platform for researchers, students and practitioners to share experiences and latest knowledge of BCSSs using behavior change models. This volume comprises the workshop proceedings of the 8th International Workshop on Behavior Change Support Systems (BCSS 2020) that took place on April 21st, 2020 in conjunction with the 15th International Conference on Persuasive Technology 2020 hosted by Aalborg

University in Denmark. The proceedings of BCSS 2020 include five research papers, two work-in-progress papers and a position paper.

Information and communication technology (ICT) has found its way into nearly all aspects of life. Homes and workplaces are filled with technology and it is increasingly ubiquitous and embedded in everyday life objects. Increasing amount of people are carrying technology on themselves wherever they go: fitness trackers, wearable sensors, and smart watches are becoming more and more common. Smart phones have become essential part of everyday life, and mobile services are basically everywhere and to be consumed instantly, contributing towards humanizing ICT [1].

With the continuous presence of technology, there is also continuous presence of persuasion. Persuasion as such is not new, we have been persuaded to behave certain ways throughout our lives from schools to buying groceries. Also, technology has never been neutral either, it always influences to our lives whether we want it or not [2]. However, technology of today is becoming increasingly aware of the context of its use, and it can identify opportune situations to help people to change or maintain desired behaviors. Latest technological developments offer overwhelming possibilities to deliberately influence the behavior of individuals, and it is highly important for designers select the right strategies and to be thoughtful of the possible outcomes of the ICT. The Persuasive Systems Design Model (PSD) [2] has received significant appreciation over the years when evaluating, designing and developing systems with persuasive intent. The PSD model provides a framework to systematically examine persuasive design elements and its categories of BCSS interventions. Naturally as the scientific field evolves further, there is a need to acquire deeper understanding of different PSD/BCSS constructs and evaluation methodologies to measure and predict effectiveness of ICT. We also need to understand the risks and benefits of new technologies that allow us to gather enormous amounts of data from multiple sources to customize and personalize persuasive activities [3]. Even though technological development offers new business and research possibilities, our BCSS community should not lose sight from serious concerns and possible ethical risks either [4].

The nature of behavior change merits further studies as well. Research in cognitive psychology suggests that largely autonomous processes can play a significant role in many behaviors: perception and even choice can have non-conscious roots [5]. In other words, changing intentions, beliefs and attitudes sometimes might not be enough for controlling behaviors. In addition, persuading an individual to behave certain way can be a onetime trigger, but often permanent behavior change requires continuous support for a longer period [6]. Especially many health challenges like obesity or depression requires long-term commitment from individuals. As important it is to study and the immediate effects of BCSSs, it is equally vital to have the broader time span view on the use and effects of these systems. In practice the formation of healthy habits can be a combination of various different behavior support strategies [7]. As a BCSS's aim is to impact people's lives, more studies on the use of ICT in their actual contexts are necessary to study how different strategies can help people to achieve better lifestyles in practice. These issues pose real challenges for practitioners and researchers in the field of Behavior Change Support Systems (BCSSs). A BCSS can be 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*" [6].

Behavior support strategies embedded in ICT products can have enormous impact on personal health, societies' overall well-being, and even the state of global ecology. These opportunities cannot be faced by practitioners and researchers from one discipline alone. They require interdisciplinary perspective and collaboration between business, public sector, and academia. BCSS workshop is one of the prominent venues to establish fruitful networks now and in the future.

## 2 Presented Work

The workshop in 2020 comprised new and interesting work on BCSSs. In this eighth occurrence of the BCSS workshop, we have eight papers presented by an international network of researchers. The papers of the BCSS 2020 workshop address three timeless themes in BCSS: design and development of effective behavior change support systems, involving end users and other stakeholders, and evaluation of Behavior Change Support Systems. We will next highlight, in brief, the key ideas behind the papers included to the proceedings of the workshop.

### 2.1 Design and Development of Effective Behavior Change Support Systems

*Preliminary study on the smartphone zombie phenomenon by utilising a monitoring application* by Kashimoto, Hyry, Karppinen, Oinas-Kukkonen, Taya, and Ono [8] study how to persuade people not to use a smartphone while walking. This type of behavior is also known as "smartphone zombie" activity, and it can lead to very dangerous accidents in the urban environment. Kashimoto and colleagues investigates smartphone zombie behavior by designing a monitoring app that was correlated to personality data using the Trans-theoretical model and the pathway model for problematic phone use.

*Multi-perspective persuasion by a council of virtual coaches* by Huizing, Klaassen, and Heylen [9] experiment perceptions of three virtual agents providing tips on weight loss. They compare two conditions, in one condition the coaches merely gave tips, and in the other they had brief discussions in between the tips. They found that the inter-coach discussion during a coaching session did have an effect e.g. in users' perceptions and commitment.

*Embedding Additional Behaviors Into Users' Daily Routines for Improving Users' Awareness of Self-Health Condition* by Zhang, Matsuda, Fujimoto, Arakawa, and Yasumoto [10] presents very interesting design, where office workers who weight themselves can use a microwave in a break room. This new design aims to promote behavior changes by embedding additional behaviors into users' daily routines, trying to improve users' awareness of their health condition.

## 2.2 Involving End Users and Other Stakeholders

*A Multi-stakeholder Process of Designing a City Platform for Sustainable Behavior: Lessons Learned* by Paraschivoiu, Layer-Wagner, Meschtscherjakov, Möstegl, Stabauer [11] applied a user-centered approach to engage multiple stakeholders in the design of a web and mobile sustainability platform. They structured a process engaging local administration, service providers and citizens. Changing behaviors with respect to climate change is a complex problem that involves not only end users, but other stakeholders as well. Paraschivoiu and colleagues argue that stakeholder engagement is a continuous process and designers need to ensure agency of all those involved.

*Living Lab for Designing Behavior A-Change* by Yasuoka [12] proposes to apply Living Lab as an approach to design attitude change. Living Lab supports in-depth understanding of the target user and their motivations, needs and their transition over long-term period. Study is based on two research cases that introduce the potential of designing Behavior Change Support System by means of Living Lab principles.

*Combining personalization, tailoring, persuasive design and gamification – Where Do We Stand?* by Enwald [13] reminds that the idea of taking personal characteristics into account in attempts to change behavior is not new. The aspects of tailoring or personalizing have been emphasized in persuasive system design, gamification research, and health communication. Enwald argues that lot could be learned from what is already known and done in other research fields. Multidisciplinary or even interdisciplinary research approaches could be useful for seeing the bigger picture in the future.

## 2.3 Evaluation of Behavior Change Support Systems

Increasing amount of mobile health apps aims to relief stress, which impacts physical, mental and emotional health. *A Systematic Review of Persuasive Strategies in Stress Management Apps* by Alhasani, Mulchandani, Oyebode, and Orji [14] use the primary task support strategies of the Persuasive Systems Design (PSD) framework to evaluate the persuasiveness of 60 stress management apps. The results reveal that personalization is the most commonly employed strategy overall, followed by self-monitoring, simulation, and tailoring.

Within the mental health problem domain *Deconstructing Persuasive Strategies in Mental Health Apps Based on User Reviews using Natural Language Processing* by Oyebode and Orji introduce the use of Text Mining method to extract knowledge from unstructured text data. In their text mining approach Oyebode and colleagues used natural language processing (NLP) techniques, especially topic modelling. They used as a sample 100 user reviews of mental health apps and studied their persuasive strategies.

## 3 Discussion

Need for interdisciplinary approaches and the benefits of viewing BCSSs from different perspectives was shown at the workshop once again. The papers provided valuable input for the online workshop and an occasion for researchers and practitioners to discuss the key issues for developing and evaluating BCSSs.

There is a demand for academic knowledge of how to apply latest technologies for behavior change from personal health to battling global climate change. In the upcoming years BCSS workshop will act as a multidisciplinary venue where experts from various backgrounds and domains, such as psychology, human-computer interaction, information sciences and medicine can present their studies and discuss new possibilities in the field of Behavior Change Support Systems.

## 4 Acknowledgements

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