

Fifth International Workshop on Behavior Change Support Systems (BCSS 2017)

in conjunction with the 12th International Conference on Persuasive Technology,
April 3-6, 2017, Amsterdam, the Netherlands

Piiastiina Tikka¹, Randy Klaassen², Pasi Karppinen¹, Robby van Delden², Roelof de
Vries², Lisette van Gemert-Pijnen³, Harri Oinas-Kukkonen¹ and Dirk Heylen²

¹Oulu Advanced Research on Service and Information Systems Group, Faculty of Information
Technology and Electrical Engineering, University of Oulu, Oulu, Finland
{piiastiina.tikka, pasi.karppinen, harri.oinas-kukkonen}@oulu.fi

²Human Media Interaction, Faculty of Electrical Engineering, Mathematics and Computer
Science, University of Twente, Enschede, The Netherlands
{r.klaassen, r.w.vandelden, r.a.j.devries@utwente.nl,
d.k.j.heylen}@utwente.nl

³Psychology, Health & Technology, Faculty of Behavioural, Management and Social
Sciences, University of Twente, Enschede, The Netherlands
{j.vangemert-pijnen}@utwente.nl

1 Introduction

Behavior Change Support Systems (BCSS), already running for the fifth time at Persuasive Technology, is a workshop that builds around the concept of systems that are specifically designed to help and support behavior change in individuals or groups. The highly multi-disciplinary nature of designing and implementing behavior change strategies and systems for the strategies has been in the forefront of this workshop from the very beginning. This year the workshop comprises new and interesting work on BCSSs in general and also a more focused theme of design and evaluation of coaching systems in the domain of health and well-being.

As technology becomes increasingly pervasive and ubiquitous, more and more of us use it to access an ever-increasing variety of services from entertainment to health-care. Sensors, wearables, tracker systems become more affordable and within the reach of ever wider audiences [1,2]. Technology that can persuade – or indeed help us persuade ourselves – now resides firmly within our everyday lives. Because of this fluency with which technology is now at the disposal of so many people we can observe a change in the paradigm of technology use: technology is becoming humanized [3] and the way we see it and how we use it is changing from being a mere utility to a partnership and service media.

The concept of BCSS is broad as regards the problem domains, but the definition of BCSS ensures that the research in this field maintains a clear identity. A BCSS can be defined as “a socio-technical information system with psychological and behavior-

al outcomes *designed* to form, alter or reinforce attitudes, behaviors or an act of complying without using coercion or deception” (emphasis added) [4]. So, from communicating persuasive messages to tracking physical activity for the purpose of self-reflection, BCSSs are drawn together by their intent: they are designed to produce a pre-defined effect in the user of a given technology. The present workshop is, as always, interested in all work around BCSSs, but this year a specific branch, coaching systems, was highlighted in the call as well.

Persuasive coaching strategies incorporated in technological products can have enormous societal impact on health and well-being. Technology is becoming ever more ubiquitous and this gives us the opportunity to coach people towards better and healthy lifestyles. When designing and evaluating coaching strategies that make use of technologies it is common to run into several challenges – be it design, methodological, technological or even ecological. These challenges cannot be tackled by researchers from one discipline alone, and as such they require a collaborative, interdisciplinary perspective. Stakeholders range from doctors and therapists to psychologists and eHealth professionals, designers and programmers, and often end-users as well.

2 BCSSs

The persuasive technology field is becoming a linking pin connecting natural and social sciences, requiring a holistic view on persuasive technologies, as well as multidisciplinary approach for design, implementation, and evaluation. Such systems can involve the user of, for example, sensors for tracking activity and physiological responses, which in turn can be used in supporting self-reflection. Use of persuasive technology aiming at behaviour change has burgeoned in recent years particularly in the area of health and personal well-being, e.g. [5, 6]. Through advances in information systems, their interfaces, and ever-increasing connectivity the possibilities for using information technology as an extension of and a tool for influencing people have reached a point where systems designed for persuasion will work fluently and even with subtlety on the devices people carry with them almost all of the time.

A pervasive problem with a lot of the research in the field of persuasive technology has to do with the lack of attention given to *how* such systems aim at influencing behaviour, and *which elements* in them exactly contribute to their effect – otherwise known as the black box phenomenon [4]. As a research lens, BCSS approach specifically aims at tracking the observable change from a system’s intention to the mechanisms of reaching the outcomes.

3 Persuasive coaching strategies and challenges

Persuasive coaching strategies incorporated in technological products can have enormous societal impact on health and well-being by coaching people towards ‘better’ and healthy lifestyles.

However, current research has not been able yet to tackle some of the challenges that come with the design and evaluation of effective technologies. For example, it is still a challenge to effectively design for long-term adherence (e.g., [7, 15]), to personalize or tailor effectively (e.g., [9, 13, 16]), to implement theoretical knowledge into technology (e.g., [7, 12]), to evaluate constructs, strategies or methods in-the-wild in various contexts (e.g., [10, 14]), to effectively make use of new possibilities in sensing and monitoring people in daily life (e.g., [8, 9]), possibly even across platforms, and to link back whatever findings we have to a deeper understanding of our users, people, theories, methods and even our strategies (e.g., [11, 12, 13]).

When designing and evaluating coaching strategies that make use of technologies, it is common to run into several challenges, be it design, methodological, theoretical, contextual, technological or even ecological. These challenges cannot be tackled by researchers from one discipline alone, and require a collaborative, interdisciplinary perspective.

4 Topics

Topics for submissions included, but by no means were limited to:

Design & Development

- Engagement, Personalization, Integration, Connectivity, and Changes in Persuasive Technology.
- Smart communication and information systems.
- Interactive visualizations for personalization and social support.
- High tech, human touch / humanizing technology.
- Persuasive prompts to create engagement and involvement: Virtual environments, ambient visualizations, etc.
- Developing just-in-time persuasive feedback to support activities real-time and offline (e.g., triggers and alerts), using data generated by smart sensors, self-tracking devices, wearable's, etc.
- Connectivity designs for social support, e.g. for lifestyle change & wellbeing.
- Persuasive profiling to personalize interventions.
- Ethical issues of persuasive technology, big data and BCSSs.
- Value proposition design to create BCSSs that have value in practice for all stakeholders, implementation issues.
- Persuasive strategies related to different outcomes (engagement/resilience/attitudes/compliance/behaviors) and levels (individual/community/society) of change.

Evaluation

- Measuring the impact of BCSSs and smart persuasive environments on individuals, community, and society.

- Evaluation methods for measuring various aspects of BCSSs; process and products measurements.
- Advanced big data analytics for measuring and interpreting self-tracking data from wearables, multi-sensor data, etc.
- Adequate design for measuring the effect of persuasive strategies on task adherence during usage and long-term effects (fractional factorial designs).
- Frameworks and methodologies to measure A/B/C-Changes (attitude, behavior or compliance).
- Profiling personalities and matching them with persuasive strategies.
- Multimodal cues and the effects on adherence and outcomes.
- Advanced analytics to predict adherence, and to identify usage patterns and its effects on adherence.
- Evaluation of persuasiveness of different BCSSs (mobile, ubiquitous, ambient technologies, virtual environments, sensor-based, etc.).
- Design guidelines for practice, based on evaluation studies.

5 Presented work at BCSS 2017

BCSSs can be used in a broad range of problem domains from health to eco-behaviour and beyond. This year's selection of papers at the BCSS workshop illustrates this potential to variety: help, support, guidance and services can be provided to those in need in various ways and in various domains.

Directly aiming at addressing a specific physical condition, Klaassen et al. (pp. 38-45) and Terzimehic et al. (pp. 46-53) report on coaching applications for health. Klaassen et al. present a proof-of-concept system for assisting young asthma patients learn and monitor their condition as well as provide an interactive playground for fitness improvement. While gamification in itself is an interesting area of persuasion and coaching, combining real physical activity and play with technology that not only provides the frame for the play but also helps monitor for example appropriate levels of activity to match the players' condition produces a new level to coaching with technology.

Terzimehic et al. build on health-care recommendations of tracking occurrences headaches by means of a diary, but with a focus on the analysis of the collected lifestyle data to provide effective feedback to the users of HeadacheCoach app. A number of lifestyle elements have been identified to be likely triggers for headaches for people with active primary headache disorder, such as sleep rhythm and eating behavior. The paper explores how to study best feedback-giving methods that would best transform the collected lifestyle data into behavior change as regards avoiding headache triggers.

Technology can also mediate a behavior change intention, as seen in a study on using Twitter in promoting a healthier diet (pp. 14-27) In such a situation, the persuader harnesses an existing system with potential to social influence as the tool for not just delivering a message but making the system users active participants in the persuasion process. On a similar track, Chen et al. (pp. 28-37) studied the use of dynamic text

messaging in helping people maintain self-tracking. The paper explores three encouragement systems, of which one encouraged participation in a social game. Making a game a collective (group) effort where players collaborate to achieve a common goal and having a real person sending text messages to promote game play appeared to increase participation and maintain self-tracking.

Presenting work-in-progress, Iyengar et al. (pp. 7-13), looked into using persuasive technology as a means of bridging a gap between clinical studies and clinical practice. Iyengar et al. make a highly interesting proposal (with some literature based evidence to support the proposal) that persuasive technology, i.e. BCSSs can provide “a useful conceptual and theoretical framework” overcoming the problem of translating clinical research into clinical practice.

Overall, the paper showed that the opportunities and challenges of designing behavior change support systems require a collaborative, interdisciplinary perspective. Stakeholders in our workshop papers range from doctors and therapists, to psychologists and eHealth professionals, designers and programmers, and often end-users as well. The importance of creating synergies between these stakeholders and researchers, empowering the interdisciplinary aspect should be reflected in our design of behavior change support systems.

References

1. van Gemert-Pijnen J.E.W.C., Peters, O., Ossebaard, H.: Improving eHealth. Eleven International publishers, The Hague (2013)
2. Kulyk, O., op den Akker, H.J.A., Klaassen, R., van Gemert-Pijnen, J.E.W.C.: Personalized Virtual Coaching for Lifestyle Support: Principles for Design and Evaluation. *International journal on advances in life sciences*. 6(3-4), 300-309 (2015)
3. Oinas-Kukkonen, H. and Oinas-Kukkonen, H.: *Humanizing the Web: Change and Social Innovation*. Palgrave Macmillan, Basingstoke (2013)
4. Oinas-Kukkonen, H.: A foundation for the study of behavior change support systems. *Personal and ubiquitous computing*. 17(6), 1223-1235 (2013).
5. Karppinen, P., Oinas-Kukkonen, H., Alahäivälä, T., Jokelainen, T., Keränen, A-M., Salo-nurmi, and Savolainen, M.: Persuasive user experiences of a health Behaviour Change Support System: A 12-month study for prevention of metabolic syndrome. *International Journal of Medical Informatics* 96 51-62 (2016)
6. Kuonanoja, L., Langrial, S., Lappalainen, P., Lappalainen, R., and Oinas-Kukkonen, H.: Treating Depression through a Behavior Change Support System without Face-to-Face Therapy. *AIS Transactions on Human-Computer Interaction* (2015)
7. de Vries, R.A.J., Truong K.P., Kwint S., Drossaert C.H.C., and Evers V.: Crowd-Designed Motivation: Motivational messages for exercise adherence based on behavior change theory. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems - CHI '16*, 297–308 (2016)

8. van Delden, R.W., Moreno, A.M., Poppe, R.W., Reidsma D., and Heylen D.K.J.: A Thing of Beauty: Steering Behavior in an Interactive Playground. In Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems, (in press), 2017
9. op den Akker, H., Klaassen, R., op den Akker, R., Jones, V. M., & Hermens, H. J.: Opportunities for smart & tailored activity coaching. In CBMS 546-547 (2013)
10. Klaassen, R., op den Akker, R., Lavrysen, T., & van Wissen, S.: User preferences for multi-device context-aware feedback in a digital coaching system. *Journal on Multimodal User Interfaces*, 7(3), 247-267 (2013)
11. Chatterjee, S., & Price, A.: Healthy Living with Persuasive Technologies: Framework, Issues, and Challenges. *Journal of the American Medical Informatics Association*, 16(2), 171–178. (2009)
12. Hekler, E. B., Klasnja, P., Froehlich, J. E., & Buman, M. P.: Mind the Theoretical Gap: Interpreting, Using, and Developing Behavioral Theory in HCI Research. *Proc. CHI 2013*, 3307–3316. (2013)
13. Oinas-Kukkonen, H.: Behavior change support systems: A research model and agenda. In *Persuasive Technology* (pp. 4–14). in collection, Springer. (2010)
14. van Delden, R. W.: (Steering) interactive play behavior. PhD thesis, University of Twente. CTIT Ph.D.-thesis series No. 17-422 ISBN 978-90-365-4304-0 (2017)
15. Klasnja, P., Consolvo, S., & Pratt, W. How to evaluate technologies for health behavior change in HCI research. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems pp. 3063–3072 (2011)
16. de Vries, R.A.J., Truong K.P., and Evers V.: Crowd-Designed Motivation: Combining Personality and the Transtheoretical Model. In *Persuasive Technology*, 41-52. Springer International Publishing. (2016)