Peter W. de Vries, Thomas Van Rompay (Eds.)

# Persuasive Technology: Development and implementation of personalized technologies to change attitudes and behaviours

**12th International Conference, PERSUASIVE 2017,**
**Amsterdam, The Netherlands, April 4-6, 2017**
Adjunct Proceedings

Second edition: April 2017

12th International Conference on Persuasive Technology, PERSUASIVE 2017,
Amsterdam, The Netherlands, April 4-6, 2017, Adjunct Proceedings
Edited by Peter W. de Vries and Thomas van Rompay



Contact:
Centre for eHealth & Wellbeing Research, Department of Psychology, Health and Technology, University of Twente, The Netherlands
PO Box 217, 7500 AE, Enschede, The Netherlands
https://www.utwente.nl/igs/ehealth/

# Preface

Persuasive Technology (PT) is an emerging, interdisciplinary research field, focusing on the design, development and evaluation of technologies aimed at creating awareness and inducing behavior change with the ultimate goal to increase wellbeing and quality of life. Academic researchers, designers, and practitioners from the social sciences and technological disciplines, as well as from the fields of health, healthcare, safety, sustainability, and ICT have developed this field in the preceding years, giving rise to a community which aims to 'persuade' people into adopting healthier lifestyles, behave more safely, and reduce consumption of renewable resources, to name a few examples. The 'technology' component in PT reflects usage of, amongst others, big data analytics, sensor technology for monitoring, personalized feedback and coaching, mHealth, data visualization techniques, serious gaming, and social media.

The 12th International Conference on Persuasive Technologies was hosted by the Centre for eHealth & Wellbeing Research, Persuasive Health Technology Lab, University of Twente (UT), the Netherlands. After previous successful conferences in Salzburg, Chicago, Padua, Sydney, Linköping, Columbus, Copenhagen, Claremont, Oulu, Palo Alto, and Eindhoven, this time the picturesque city of Amsterdam was the place to be. For this conference, the special theme was "smart monitoring and persuasive coaching; building bridges between persuasion and personalized healthcare via real-time data collection and smart, empathic, user-adaptive engaging technology".

Although still emerging and expanding (in parallel with the latest and upcoming technological developments and the opportunities they provide for managing behavior change), we feel that the field of Persuasive Technology is reaching maturity as indicated by the continuing increase in papers submitted to PT conferences along the years, a trend we believe will persist in the years to come as opportunities for technology-induced behavior change will steadily (or perhaps rather 'exponentially') continue to grow.

Importantly however, our community is not defined and shaped merely from a technological point of view. That is, throughout the years, equal emphasis has been placed on gathering insights and a deeper understanding of the user involved and his or her needs, skills, and (cognitive) capabilities. Obviously, this is for a good reason, as any attempt at behavior change should be driven by a comprehensive understanding of the goals and needs of the people involved.

From our point of view, a contribution to our field should thus have both technology and people at its core, something which is also reflected by the University of Twente's 'HI TECH, HUMAN TOUCH' philosophy. Taking note of these 'requirements', we are proud to say that the contributions to this conference (comprising papers, posters, demos, workshops, and contributions to symposia and doctoral colloquia) deliver and live up to the promise of connecting people and technology in order to enhance the quality of our life.

In this volume of adjunct proceedings, we present the posters abstracts, demos, symposia, doctoral consortium papers, workshop proposals, and tutorial contributions. Ranging from linkages between gamification and heathy habits, design strategies for creating awareness and persistence, to big data analytics aimed at uncovering 'hidden' behavior patterns, the work presented here will inspire, educate, and motivate its reader and attract new contributors to our field. After all, in a world where augmented reality, the internet of things, and robotics have just seen the light of day, certainly the best is yet to come.

We would like to thank all authors for their high-quality contributions which not only provide a comprehensive overview of our discipline and its landmarks so far, but also provide a sketch of the shape of things to come.

Just as our discipline involves a dialogue between people and technology, the contributions you will find here involve a dialogue between authors and reviewers. Thanks to all reviewers for their valuable feedback, ideas and suggestions. Finally, thanks to our colleagues and students involved in the overall organization, the workshops, tutorials, doctoral consortium, posters, demos, symposia, and the conference itself. None of this would have been possible without your support, trust and dedication.

April 2017

Thomas Van Rompay
Peter W. de Vries

# Organization

## General Chair

| | |
|---|---|
| Lisette van Gemert-Pijnen | University of Twente, The Netherlands |

## Organizing Chair

| | |
|---|---|
| Liseth Siemons | University of Twente, The Netherlands |
| Nienke Beerlage-de Jong | University of Twente, The Netherlands |

## Program Chair

| | |
|---|---|
| Peter W. de Vries | University of Twente, The Netherlands |
| Harri Oinas-Kukkonen | University of Oulu, Finland |

## Tutorial/Doctoral Chair

| | |
|---|---|
| Jaap Ham | Eindhoven University of Technology, The Netherlands |
| Cees Midden | Eindhoven University of Technology, The Netherlands |
| Luciano Gamberini | University of Padova, Italy |

## Workshop Chair

| | |
|---|---|
| Saskia Kelders | University of Twente, The Netherlands |
| Geke Ludden | University of Twente, The Netherlands |

## Poster and Demo Chair

| | |
|---|---|
| Thomas Van Rompay | University of Twente, The Netherlands |

## Public Relations

| | |
|---|---|
| Hanneke Kip | University of Twente, The Netherlands |
| Floor Sieverink | University of Twente, The Netherlands |

## Social Media Committee

| | |
|---|---|
| Agnis Stibe | MIT Media Lab, MA, USA |
| Geke Ludden | University of Twente, The Netherlands |

## Administration

| | |
|---|---|
| Marieke Smellink-Kleisman | University of Twente, The Netherlands |

## Program Committee Members

| | |
|---|---|
| Ali Rajan | Bournemouth University, UK |
| Nienke Beerlage-de Jong | University of Twente, The Netherlands |
| Shlomo Berkovsky | CSIRO, Australia |
| Robbert Jan Beun | Utrecht University, The Netherlands |
| Samir Chatterjee | Claremont Graduate University, USA |
| Luca Chittaro | University of Udine, Italy |
| Jacqueline Corbett | Smithsonian Institution, USA |
| Janet Davis | Whitman College, USA |
| Johannes de Boer | Saxion University of Applied Sciences, The Netherlands |
| Boris de Ruyter | Philips Research, The Netherlands |
| Peter de Vries | University of Twente, The Netherlands |
| Alexander Felfernig | Graz University of Technology, Austria |
| Jill Freyne | CSIRO, Australia |
| Luciano Gamberini | University of Padua, Italy |
| Sandra Burri Gram-Hansen | Aalborg University, Denmark |
| Ulrike Gretzel | University of Southern California, USA |
| Jaap Ham | Eindhoven University of Technology, The Netherlands |
| Marja Harjumaa | VTT, Finland |
| Stephen Intille | Northeastern University, Massachusetts, USA |
| Giulio Jacucci | University of Helsinki, Finland |
| Anthony Jameson | German Research Center for Artificial Intelligence (DFKI), Germany |
| Maurits Kaptein | Tilburg University, The Netherlands |
| Sarvnaz Karimi | CSIRO, Australia |
| Pasi Karppinen | University of Oulu, Finland |
| Saskia Kelders | University of Twente, The Netherlands |
| Sitwat Langrial | Sur University College, Oman |
| Geke Ludden | University of Twente, The Netherlands |
| Thomas MacTavish | Illinois Institute of Technology, USA |
| Alexander Meschtscherjakov | University of Salzburg, Austria |
| Cees Midden | Eindhoven University of Technology, The Netherlands |
| Alexandra Millonig | AIT Austrian Institute of Technology, Austria |
| Harri Oinas-Kukkonen | University of Oulu, Finland |
| Rita Orji | University of Waterloo, Canada |
| Peter Ruijten | Eindhoven University of Technology, The Netherlands |
| Liseth Siemons | University of Twente, The Netherlands |
| Anna Spagnolli | University of Padua, Italy |
| Agnis Stibe | MIT Media Lab, USA |
| Piiastiina Tikka | University of Oulu, Finland |
| Kristian Tørning | Danish School of Media and Journalism, Denmark |
| Manfred Tscheligi | University of Salzburg & AIT, Austria |
| Lisette van Gemert-Pijnen | University of Twente, The Netherlands |
| Thomas Van Rompay | University of Twente, The Netherlands |
| Julita Vassileva | University of Saskatchewan, Canada |
| Vance Wilson | Worcester Polytechnic Institute, USA |
| Khin Than Win | University of Wollongong, Australia |

## Sponsors

We would like to thank our sponsors for their support:




ConnectedCare develops engaging digital communication and collaboration applications for independent living and ageing, and brings innovations to market. Our team of ICT-experts, designers and business developers are experienced in design methodologies, user-centered design, service design, care collaboration, user interface development and business development in the context of care collaboration and independent living. ConnectedCare – your flexible partner in EU care innovations.


A leading research centre for personalized health care. The Centre captures the available scientific expertise within the Department of Psychology, Health and Technology (University of Twente). Our mission is to apply psychological knowledge in the design and evaluation of technological innovations that contribute to well-being, health and personalized healthcare.

# Table of Contents

## Poster Abstracts

## Doctoral Consortium Papers



## Tutorials

## Demos



## Workshop Proposals



## Symposium

# Poster Abstracts

**Poster Chair**

Thomas Van Rompay University of Twente, The Netherlands

# The Impact of Age, Gender and Level of Education on the Persuasiveness of Influence Strategies in E-commerce

Ifeoma Adaji & Julita Vassileva

University of Saskatchewan, Saskatoon, Canada
✉ {ifeoma.adaji, julita.vassileva}@usask.ca

## Introduction

With the increase in the number of online businesses, companies have to put strategies in place in order to create a unique shopping experience for their clients. Personalization and persuasive technology have been identified as means through which e-businesses can customize their client's shopping experience.

Research has shown that the demographics of customers can be used in creating a personalized experience for shoppers [1]. In this poster, we explore the response of e-commerce customers to the influence strategies of the Persuasive Systems Design (PSD) framework [2] according to their demographics.

To investigate the extent to which age, gender and level of education influence the effect of the persuasive strategies of the PSD framework, we conducted a user study of e-commerce shoppers using Amazon.com as a case study and a sample size of 324 Amazon shoppers. We used previously validated scales of Lehto and Kukkonen [3] that measures the constructs of the PSD framework (dialogue support, primary task support, social support and system credibility support), effectiveness and use continuance. Users were classified into three age groups; 18-24 (n=90), 25-34 (n=133) and > 34 (n=94). Seven users chose not to provide their age. There were 175 female and 146 male participants; four users chose not to respond. There were three categories of level of education; high school (n=85), Bachelor's degree (n=125) and graduate studies (n =110), four participants chose not to respond to this question.

## Data Analysis and Results

We validated our instrument by computing the Kaiser-Meyer-Olkin adequacy and the Bartlett Test of Sphericity which were both found to be significant. We computed the Repeated-Measure ANOVA (RM-ANOVA) with the persuasive strategies (dialogue support, primary task support, social support, review credibility support, product credibility support, system credibility support, effectiveness and use continuance) as within-subject factors and age, gender and level of education as between-subject factors to identify any significant differences within the groups.

Our results show that there was significant main effects on the likelihood of influencing our participants using the influence strategies. However, within the three age groups 18-24, 25-34 and > 34, there wasn't any significant difference in the effect of these strategies. This means that the effect of the various influence strategies was the same for all age groups in the study. Similarly, males and females did not show any significant differences on the influence of the persuasive strategies.

With respect to the level of education of participants, there was significant interaction between the three levels of education and the effect of the persuasive strategies, $F(2, 317) = 5.195$, $p < 0.05$. This shows that participants in various levels of education were influenced differently. Overall, Bachelor's degree holders were more likely to be influenced by the strategies than high school holders and graduate degree holders. Pairwise comparison showed that Bachelor's degree holders significantly differed in five of the eight strategies, namely: social support, review credibility, system credibility, product credibility and perceived effectiveness.

## Conclusion

To investigate the differences in customers' response to the persuasive strategies of the PSD framework based on age, gender and level of education, we carried out a study using Amazon

shoppers. Our results show that differences in age and gender do not reveal any significant change in the response to persuasive strategies, but, level of education show significant differences in 5 of the persuasive strategies: social support, review credibility, system credibility, product credibility and perceived effectiveness.

## References

1. A. L. Montgomery and M. D. Smith, "Prospects for Personalization on the Internet," *J. Interact. Mark.*, vol. 23, no. 2, pp. 130–137, 2009.
2. H. Oinas-Kukkonen and M. Harjumaa, "A systematic framework for designing and evaluating persuasive systems," in *Persuasive technology*, Springer, 2008, pp. 164–176.
3. T. Lehto and H. Oinas-Kukkonen, "Explaining & predicting perceived effectiveness & use continuance intention of a BCSS for weight loss," *Behav. Inf. Technol.*, vol. 34, no. 2, pp. 176–189, Feb. 2015.

# Using Markov Chains to analyze paths through a Personal Health Record

Saskia M. Akkersdijk , Saskia M. Kelders, Louise M. A. Braakman – Jansen, & Lisette van Gemert – Pijnen

University of Twente, The Netherlands
✉ s.m.akkersdijk@utwente.nl

Personal Health Records (PHRs) can play an important role in facilitating information exchange, monitoring disease management, and coaching self-management behavior. Although there are many potential benefits of PHR's only small improvements have been measured [1]. Evaluations of PHR's have, up to now, failed to provide insight into why these outcomes did occur [2], because we approach them as a black box. Analysis of log data has the potential to explain effects of a technology [3], and Markov modeling can be used to identify navigation paths. A Markov Chain model describes a system that consists of a "chain" of events. Each chain consists of a set of states and a set of transitions between them. A transition has a probability indicating the likelihood of a transition occurring. Using Markov Chains to analyze navigation paths could potentially be of added value when evaluating a PHR [4].
Analyzing log data about sessions of users on a PHR (which parts of the PHR are visited sequential) with a Markov model could potentially provide extra value. It tells you about the most likely transition they are going to make, which in turn could potentially provide valuable information on identifying problems and can help explaining outcomes. While most logdata analysis now focuses mostly on providing an overview of the usages of a system (e.g. how often is it used, at which intervals, at which moments), analysis of logdata with a Markov Chain goes a step further, and provides more in-depth information.

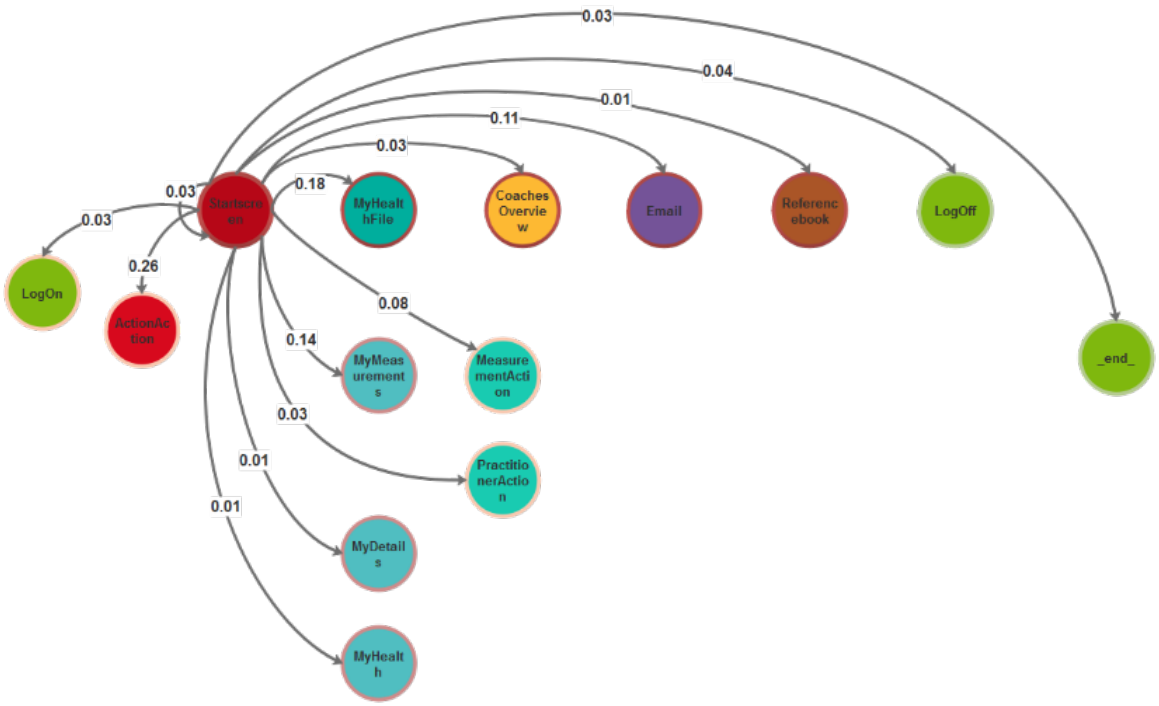


*Figure 1:Part of the Markov Chain Model of MHP (focused on the first step after login)*

Two years of logdata from My Health Platform (MHP) (an online platform to support self-care and self-management) were used to create a Markov Chain model. A small part of the model can be seen in figure 1 in which is focused on the first step after login.

Focus lies on explaining and interpreting the prominent results, their implications, the method used and the added value of this method.

## References

1. M. Tenforde, A. Nowacki, A. Jain, J. Hickner, The association between personal health record use and diabetes quality measures., Journal of general internal medicine 27 (4) (2012) 420{4. doi:10.1007/s11606-011-1889-0. URL http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3304034&tool=pmcentrez&rendertype=abstract
2. D. Black, J. Car, C. Pagliari, C. Anandan, K. Cresswell, T. Bokun, B. McKinstry, R. Procter, A. Majeed, A. Sheikh, The impact of eHealth on the quality and safety of health care: a systematic overview., PLoS medicine 8 (1) (2011) e1000387. doi:10.1371/journal.pmed.1000387. URL http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3022523&tool=pmcentrez&rendertype=abstract
3. J. Y. Han, Transaction logfile analysis in health communication research: Challenges and opportunities, Patient Education and Counseling 82 (3) (2011) 307 { 312, methodology in Health Communication Research. doi:http://dx.doi.org/10.1016/j.pec.2010.12.018. URL http://www.sciencedirect.com/science/article/pii/S0738399110007901
4. H. Tian, J. D. Brimmer, S. J.-M. Lin, J. A. Tumpey, C. W. Reeves, Web usage data as a means of evaluating public health messaging and outreach, J Med Internet Res 11 (4) (2009) e52. doi:10.2196/jmir.1278. URL http://www.jmir.org/2009/4/e52/

## Storyboarding persuasion to match personality traits

Nienke Beerlage – de Jong, Christian Wrede, Lisette van Gemert – Pijnen, & Floor Sieverink

University of Twente, Enschede, The Netherlands
✉ {n.beerlage-dejong, j.vangemert-pijnen, f.sieverink}@utwente.nl, c.wrede@student.utwente.nl

### Background
Health-promoting technology, using persuasion to shape, change or reinforce behaviour, is still growing in number and popularity [1,2]. This also resulted in a growing attention on how to tailor persuasive strategies to different users and user groups to achieve desirable outcomes and to maximize the success of such technologies [3]. One of such possibilities for tailored persuasion, is to look at the needs and preferences of different types of personalities [4]. To enable such tailoring, there is a growing need for easily applicable (e.g., low effort, low costs) methods to study the relation between personality and persuasion. The development and evaluation of low-fidelity storyboards (a small coherent set of easily understandable comic-book-like illustrations) fulfil these needs [5].

### Purpose
The aim of this study is (1) to gain more insight into the relationship between personality traits and preferences for certain persuasive strategies in health-promoting technology and (2) to demonstrate an easily applicable method of studying this relationship. We build upon existing research [3] and complement it with the Persuasive Systems Design (PSD) Model [2].

### Method
A literature scan was conducted to make a selection of eight persuasive strategies from the PSD model that are generically applicable (independent of user characteristics, unlike e.g., similarity) and most frequently applied in persuasive technologies [6-8]. Every strategy (self-monitoring, simulation, reminders, rewards, expertise, real-world feel, social comparison, and recognition) is represented in standardized storyboards that only vary in persuasive strategies, keeping other factors (e.g. device and colours) equal. The storyboards are pilot-tested among six experts to check whether the PSD strategies are recognized.
The final storyboards were then presented online (via Qualtrics software) to a convenience sample of the general public. In concordance with Halko & Kientz [3] they were asked to indicate their appreciation of the storyboards through seven questions, concerning enjoyment, likelihood of use, helpfulness, quality of life, ease of use and time saving (all on a 7-point Likert scale). In addition, the Dutch version of the Ten Item Personality Inventory (TIPI) [9] was used to gain insight into the respondents' personality traits (using a 7-point Likert scale).

### Results
A total of 170 questionnaires were included in the study (all demographic and personality data were entered and at least one storyboard was evaluated). The mean age of participants was 23.47 (18-46). Of these, 113 were female. All of the Big-Five personality traits were significantly related (positively or negatively) to one or more persuasive strategies.
Most persuasive strategies were deemed to increase ease of use. Respondents with different personality traits sometimes disliked the same persuasive strategy for different reasons (e.g. rewards had a negative correlation with helpfulness for neurotic people and with ease of use for extravert people).
The most positive correlations were found for the conscientious people, all relating to ease of use (i.e. real-world feel, social comparison and recognition). Most negative correlations were found for neurotic people, all relating to quality of life, helpfulness or enjoyment.

## Conclusion

We conclude that there is a statistically significant association between certain personality traits and preferences for persuasive strategies in health-promoting mobile applications. This means that persuasion might be more effective when it is tailored to the users' or user groups' personality rather than implemented generically. This study has shown the potential of using low-fidelity storyboards for studying this phenomenon and for enabling tailoring of persuasion to the personality.

## References

1. Drozd, F., Lehto, T., & Oinas-Kukkonen, H. (2012) *Exploring perceived persuasiveness of a behavior change support system: A structural model.* Vol. 7284 LNCS. Lecture Notes in Computer Science (pp. 157-168).
2. Oinas-Kukkonen, H., & Harjumaa, M. (2009). *Persuasive systems design: Key issues, process model, and system features.* Communications of the Association for Information Systems, 24(1), 485-500.
3. Halko, S., & Kientz, J. A., (2010) *Personality and persuasive technology: An exploratory study on health-promoting mobile applications.* Vol. 6137 LNCS. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics) (pp. 150-161).
4. Alkış, N., and Tuğba T.T., (2015) *The impact of individual differences on influence strategies.* Personality and Individual Differences 87: 147-152.
5. Truong, K. N., Hayes, G. R., & Abowd, G. D., (2006). *Storyboarding: an empirical determination of best practices and effective guidelines.* Proceedings of the 6th conference on Designing Interactive systems.
6. Wiafe, I., and Keiichi N., (2012) *Bibliographic Analysis of Persuasive Systems: Techniques; Methods and Domains of Application*. Adjunct proceedings of the 7th International Conference on Persuasive Technology, No. 068.
7. Orji, R., Vassileva, J., & Mandryk, R. L. (2014). *Modeling the efficacy of persuasive strategies for different gamer types in serious games for health.* User Modeling and User-Adapted Interaction, 24(5), 453-498.
8. Lehto, T., & Oinas-Kukkonen, H. (2010). *Persuasive features in six weight loss websites: A qualitative evaluation Persuasive technology,* (pp. 162-173): Springer.
9. Hofmans, J., Kuppens, P., & Allik, J. (2008). *Is short in length short in content? An examination of the domain representation of the Ten Item Personality Inventory scales in Dutch language.* Personality and Individual Differences, 45(8), 750-755.

# Healthy by design: involving the target group for effective persuasive design

Astrid Bontenbal[1], Frens Pries[2], Fenne van Doorn[1], & Gitte Kloek[3]

[1]Delft University of Technology, Delft, The Netherlands
[2]Frens Pries Research & Design, Delft, The Netherlands
[3]The Hague University of Applied Sciences, Den Haag, The Netherlands
✉ a.bontenbal@tudelft.nl

## Introduction

This paper illustrates the benefits of involving the intended target group in a persuasive design project. In the ZonMw project 'Healthy by Design', insights in the needs, experiences, and motivations from the target group of secondary Vocational Education and Training (VET) students, will lead to an intervention design that fits better into their daily life than an intervention developed by solely adults for students without involving them.

## Purpose

Many VET students do not reach the public health guidelines for physical activity and nutrition [1-2]. These unhealthy lifestyle behaviors can lead to lower academic performance and school drop-out [3] and can increase the risk of major non-communicable disease in later life [4-5]. Since there are no effective Dutch school-based interventions yet that target the lifestyle of VET students in their social and physical environment, the project 'Healthy by Design' aims to develop, implement and evaluate a theory-based intervention that consciously or subconsciously changes students' lifestyle behavior at school.

The project is unique in actively involving the VET students in the intervention development by applying contextmapping [6] as well as co-research [7] in the explorative research phase. By involving them in the design process from the start, VET students feel empowered and experience ownership of the solutions for adopting a healthy lifestyle. The insights from the target group are used for the development of a persuasive design concentrating on different lifestyle aspects, and subconscious as well as conscious lifestyle behavior.

## Methods

14 vocational students (7 men, 7 women), aged 18-26, participated in the contextmapping study. First, the participants all received a sensitizing booklet with little assignments in which they observed their own daily lives during 5 days. This prepared them for the next step: the participants came together for a generative session (± 240 minutes), led by two moderators, in which the generative techniques helped the participants to talk about daily life and more specific about a healthy lifestyle. The sessions were recorded and transcribed in order to analyze the conversations.

Where the contextmapping research provided in-depth insights in the lifestyle, needs, desires and experiences of VET students with a broad scope, the co-research was focused on their perspective on nutrition and physical activity, as well as their intrinsic motivations in life. Two groups of two students participated in nine co-research sessions of one hour. By giving the VET students the role of co-researcher they actively searched for insights from their peers by, for example, conducting interviews. Listening to others enabled the co-researchers to share stories from their peers as well as in depth insights in their own experiences [8].

## Results

The contextmapping research identified six partially overlapping clusters of user insights: health behavior awareness; motivations in life; the role of peer pressure; the role of the home environment; passive attitude; and practical mindset. For most vocational students a healthy lifestyle seems not to be a current motivational factor, however earning money, looks, and family, are important motivations in the life of VET students. They often mention a lack self-

discipline and both peers and home environment seem to have great influence on their decisions. Facilitators of behavioral change should be practical, quick, and clear due to their short-term orientation and practical mindset.

By deepening the insights from the contextmapping study, four personas representing the target group were created. The research findings led to four design direction: 1) Involve seniors to motivate juniors, 2) A healthy school environment, 3) Health as a by-product of intrinsic motivations, and, 4) Increasing knowledge through (social) media. A combination of ideas, including all different design directions, will be made to make a solution we expect being most effective in promoting physical activity and healthy dietary behavior of VET students.

**Conclusions**

The close involvement of members from the target group as co-researchers in the exploratory research allowed us to base the conceptualization on deep insights of VET students' life to specifically match their needs, motivations, and attitude.

**Next Steps**

Where a lot of intervention designs are not tested for effectiveness, this project includes an effect study. In the coming two school years, the intervention will be implemented in the social and physical environment of 1000 VET students at three locations of ROC Mondriaan, a school for secondary vocational education in the The Hague area in The Netherlands.

**References**

1. Bernaards, C. M., & Van Buuren, S. (2012). *Rapportage veranderingen in het beweeggedrag van mbo studenten*. Leiden: TNO.
2. Rijpstra, A., & Bernaards, C. (2011). *De leefstijl van MBO studenten in Nederland 2009/2010*. Leiden: TNO.
3. Bradley, B. J., & Greene, A. C. (2013). Do health and education agencies in the United States share responsibility for academic achievement and health? A review of 25 years of evidence about the relationship of adolescents' academic achievement and health behaviors. *Journal of Adolescent Health*, *52*(5), 523-532.
4. Lee, I. M., Shiroma, E. J., Lobelo, F., Puska, P., Blair, S. N., Katzmarzyk, P. T., & Lancet Physical Activity Series Working Group. (2012). Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *The lancet*, *380*(9838), 219-229.
5. Chau, J. Y., Grunseit, A. C., Chey, T., Stamatakis, E., Brown, W. J., Matthews, C. E., ... & van der Ploeg, H. P. (2013). Daily sitting time and all-cause mortality: a meta-analysis. *PloS one*, *8*(11), e80000.
6. Visser, F. S., Stappers, P. J., Van der Lugt, R., & Sanders, E. B. (2005). Contextmapping: experiences from practice. *CoDesign*, *1*(2), 119-149.
7. Van Doorn, F. A. P., Gielen, M. A., & Stappers, P. J. (2013). Friends sharing opinions: users become co-researchers to evaluate design concepts. In *IASDR 2013: Proceedings of the 5th International Congress of International Association of Societies of Design Research" Consilience and Innovation in Design", Tokyo, Japan, 26-30 August 2013*.
8. Van Doorn, F. A. P. (2016). Children as co-researchers in design: Enabling users to gather, share and enrich contextual data. TU Delft Repository, Delft.

# A person-adaptive e-health platform for physiological remote monitoring and persuasive use

Sara Casaccia, Filippo Pietroni, Michela Pirozzi, Lorenzo Scalise, & Gian Marco Revel

Università Politecnica delle Marche, Ancona, Italy
✉ s.casaccia@univpm.it

## Goal

The present work is based on the development of an e-health platform characterized by a smart home system to monitor physiological parameters of users at home and a mobile application (Android open-source APIs and proprietary communication protocols for the commercial devices adopted) to both monitor and interact with the user, while he is performing different activities. The novel concept of this system is to provide a unique framework to deal with the acquisition of the user's physiological quantities by means of heterogeneous devices in different situations, at home or outside. The main goal is to manage correctly such data to give the user high level information about his general health status, to analyze data in order to find singularities in the signals/data to promote a continuous use of the platform and to increase the interest of the user in monitoring his physiological quantities.

## Materials and methods

A pilot study with real users, performed for a few months and currently ongoing, has been conducted to improve the system (implemented in the Health@Home scenario, Italian Smart-Cities project) in terms of interoperability, measurement procedure, features extraction, data mining, user interface and to define how the data measured can be analyzed for different use cases and how to use them to motivate the user. Four healthy adults were investigated in their houses, where the fixed platform was installed. Several quantities have been measured: ECG signal, Heart Rate (HR), Respiration Rate (RR), body temperature, body weight, oxygen saturation and blood pressure. The software architecture covers different aspects: graphical user interface (GUI), communication with biomedical devices, data storage and data processing in order to get refined values from the raw quantities. Acquisition and storage of data are activated through a simplified GUI and a synthetic voice guides the user during the entire acquisitions (10 minutes per day). The platform in [1] is used when the user is at home, seated on a chair with the system in front of him. Otherwise, when the user is moving or is outside, he can measure and visualize his parameters, e.g. the data coming from the multi-parametric belt, Zephyr Bioharness 3.0 [2], on a smartphone/tablet. The system is also designed to provide feedback to the user. The fixed platform alerts the user when a singularity is identified to motivate him to carry out another measurement during the day or a specific measurement schedule during the week with a non-stressful procedure. On the other hand, when the user is outside, the mobile platform warns him if a fixed limit (e.g. computed HR value) has been exceeded through an alert message on his smartphone or tablet and stores the singularity (e.g. about QT interval) making available the call button when the singularity is repeated several times.

## Analysis of results

The processing of data acquired allows users to obtain useful information about their daily and sportive activities, together with dedicated and physiologically relevant indicators. A data analysis to find singularities (e.g. time intervals out of physiological range, arrhythmias, etc.) in the ECG signal has been developed and a specific algorithm [3] has been implemented to calculate the time intervals (PR, QR, QT and ST) from the ECG waveform and to find singularities. In particular, the application is designed to record significant events in a dedicated section (e.g. when QT is higher than average) and suggests the user to consult a doctor if the situation occurs frequently with generic indications. On the contrary, more specific information are remotely accessible for the care giver. The overall results is the development and the

preliminary experimentation of an e-health architecture to monitor physiological quantities of users and a methodology to persuade them to use such system. In the preliminary experimentation the different users presented positive attitude, but each of them with different reactions to the methodology: in some cases they are very motivated about understanding and checking results, in others they are concerned about dealing with data that they do not fully understand. The feedbacks from the users are now being used to generate requirements and to tune the GUI to make it more user-friendly and accessible.

**Acknowledgments**
The research work has been developed within the framework of the Health@Home Italian project, financed by MIUR (Italian Ministry of Education, University and Research).

**References**

1. Scalise L., et al., *Implementation of an "at-home" e-health system using heterogeneous devices*, in *Proc. 2nd IEEE International Smart Cities Conference (ISC2 2016)*, Sep. 12–15, 2016.
2. Johnstone, J.A. et all., *BioHarness™ multivariable monitoring device: part. I: validity.* Journal of Sports Science & medicine, 2012. **11**(3): p. 400, 409, 643.
3. Cosoli G., et al., *A novel approach for features extraction in physiological signals*, in *Proc: IEEE International Symposium on Medical Measurements and Applications (MeMeA 2015)*, pp. 380-385, 2015.

**Provoking breath: an exploration of how to remind people to breathe**

Vanessa Julia Carpenter & Dan Overholt

Technical Doctoral School of IT and Design, Aalborg University, Copenhagen, Denmark
✉ vjc@create.aau.dk

People forget to breathe. In this work, we explore the subject of breath, specifically how to remind people through subtle indicators or coaching, to remind them to breathe throughout their workday. Much research has been done into the effects of focused breathing, of deep breathing, and of a variety of breathing techniques [1]. However, on a very basic level, breathing brings oxygen to the body and with more oxygen, they have better brain function, blood flow, and overall wellbeing [2]. Studies of people working in offices, at desks, have shown that people do not focus on breathing often enough, despite the stress reducing qualities it offers and the increased focus it can provide [3]. Beyond a lack of focus on breathing, some also stop breathing or even hold their breath while sending emails [4].

Our ambition is to discover if we can encourage people in an office environment (desk work) to breathe more mindfully through persuasive interactions with extremely simple interactions. We created two prototypes, one which is subtle: an unusual, but static part of the environment, envisioned to sit beside the communal coffee machine in a 200-person office space. The second is an interactive device, training people to breathe deeply and follow a pattern of breathing. The first prototype will be explored in this work.

A variety of devices already offer breathing training, or reminding you to breathe. Apple's "Breathe" app [5] for the Apple Watch coaches you with different breathing techniques and haptic feedback and reminds you to breathe throughout the day. Fitbit [6] offers a "Guided breathing experience" through their Relax app. BreathMinder [7] trains you to breathe at a pace and reminds you to do breathing exercises. Spire [8], a small discrete wearable tracks your respiration throughout the day alerts you to when you are tense.

As opposed to requiring people to wear a device which they might not own or be interested in owning, our goal was to create something which was placed in a communal area. We are primarily interested in communal areas, which for our initial evaluation context includes a common coffee room where many people from an office building go for their coffee breaks two to three times per day.

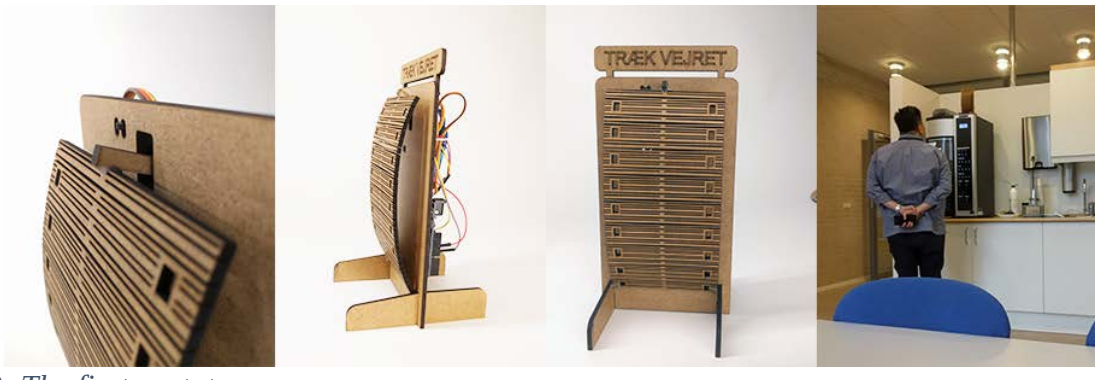


*Figure 2: The first prototype*

**The first prototype: (Figure 1)**
A simple piece of laser cut wood, cut accordion style so it is flexible is the basis for this prototype. The top of the wood is attached to a servo motor which moves back and forth,

pausing at the ‘top’ and ‘bottom’ of the movement. As the wood is moved up and down by the servo motor, it pauses at the bottom, creating a rounded shape, and pauses, representing inhalation, a full stomach; then it returns to the top and pauses there for a longer moment, representing the space between breaths. The timing was based on the average adult breathing rate according to a website dedicated to respiratory rate information [9]. Above the flexible piece of wood was a legible inscription which said “breathe”.

This prototype was placed on top of an industrial coffee machine in the break room, just above eye level. Since the prototype was small, 12.5cm tall, it was not the primary focus when getting a coffee. When fabricating the prototype, we thought about the sound of the servo and decided that perhaps it might be either overshadowed by the sound of the coffee machine grinding and brewing coffee, or could be an intriguing method to gain attention of the person using the coffee machine. In testing it could be seen that as people waited for their coffee, they were able to hear the sound of the servo motor and looked upwards to see the prototype. Preliminary testing was conducted over a period of three days with the small prototype being placed on top of the coffee machine for each day.

Upon studying more than 20 visitors over three days, some patterns emerged. When more than one person was present to get a coffee, the person directly in front of the machine generally glanced at the prototype and continued getting their coffee and ignored the prototype. When a single person was alone and getting a coffee, it was observed that they typically first peered behind the prototype to look at the servo motor and then, from what we could determine through visual observation alone, approximately 4 out of 20 visitors visibly stood up straighter and breathed into their stomachs in time with the machine. On several occasions, groups of people contemplated the device together and tried to emulate the breathing rate. Two short one minute interviews of people who had used the coffee machine and then gone back to their offices revealed that they did had not noticed the prototype at all.

From this initial investigation, it can be seen that much more research can be done. In our future work, we are primarily interested to learn about the difference between the first prototype (a subtle static device) versus the second prototype (an interactive, responsive device) and how the effects of experiences either prototype carries into the office worker’s day (or not).

## References

1. Novotny, S. and Kravitz, L., 2007. The science of breathing. IDEA Fitness Journal, 4(2), pp.36-43. https://www.unm.edu/~lkravitz/Article%20folder/Breathing.html
2. Dusek, J.A. et al., 2008. Genomic Counter-Stress Changes Induced by the Relaxation Response P. Awadalla, ed. PLoS ONE, 3(7), p.e2576. Available at: http://dx.doi.org/10.1371/journal.pone.0002576.
3. Bumatay, A.L. & Seo, J.H., 2015. Mobile haptic system design to evoke relaxation through paced breathing. ACM SIGGRAPH 2015 Posters on SIGGRAPH ’15. Available at: http://dx.doi.org/10.1145/2787626.2792627
4. Stone, L., 2011. Just breathe: building the case for email apnea (The Huffington Post). http://www.huffingtonpost.com/linda-stone/just-breathe-building-the_b_85651.html
5. Apple: Breathe app: Retrieved 27/01/2016 from: https://support.apple.com/en-us/HT206999
6. FitBit: Here’s Why You’ll Love Relax, Fitbit’s New Guided Breathing Experience Retrieved 27/01/2016 from: https://blog.fitbit.com/heres-why-youll-love-fitbits-new-guided-breathing-experience/
7. BreathMinder, your personal breathing coach: Retrieved 27/01/2016 from: http://www.breathminder.com/
8. Spire, The Mindfulness + Activity Tracker: Retrieved 27/01/2016 from: https://spire.io/
9. Normal Breathing. Retrieved 27/01/2016 from: http://www.normalbreathing.com

# The Consideration for Designing a Cooperative Persuasive Game

Yong-Xiang Chen, Pin-Hsin Lin, Hsin-Wen Liang, & Yi-Ping Hung

IoX Center, National Taiwan University, Taipei, Taiwan
✉ ntu.csie.hp@gmail.com

## Introduction

Using persuasive game for serious purpose has been studied for many years. Cooperation and competition mechanisms can be designed as game patterns. For example, Fish'n'Steps[1] is a system used for motivating people to exercise more than usual with cooperation. However, the challenge of it is how to stimulate people to collaborate. To find a better design for enhancing the effect of cooperation and competition in persuasive game, we had iteratively developed a navigation game with two versions, the second version is modified base on the player feedbacks for the first game version. We applied the game to a testing scenario, in which we persuaded individuals to adhere a regular health recording task. After analysed the player feedbacks for the two game versions, we proposed four design suggestions for further cooperative persuasive game design.

## Game Design Framework

Referring to past researches of game factors [2][3][4], we developed two versions of navigation game with player collaboration in virtual world. In two games, players should complete target behaviour (Answer 10 questions about personal health by the App every day) in reality, and then they could get related game points which was used to earn score in our persuasive game. Besides, we designed "prosocial rewards" [5] in both game versions. In order to win in weekly team-competition, team players could cooperate and get additional scores, that is, pass game hints to teammate and earn scores efficiently. There were four different design features about cooperation and competition in two game versions. The four design features were granularity of leaderboard, communication channel, balance of competition and level of cooperation, which were followed by the game factors ranking[2], social play[3], fair play[3] and complementary[4] respectively.

1. Granularity of leaderboard (version one: inter-team ranking; version two: inter-team and intra team ranking): Version one was designed to follow idea of [1] to avoid players with lower score becoming discouraged, but in our field study, we observed that the performance of lower score players didn't be improved. Therefore, we added intra-ranking in version two for comparing player behaviours.
2. Communication channel (version one: chatroom in game; version two: chatroom in game and daily used channel): We followed [1] to include a game chatroom but got a low use rate. It was because that some users were not interested in game so they seldom played our game, which resulted in fewer opportunities of noticing game chatroom and being persuaded. We then included a common used messanger App as extra communication channel, such as Facebook or LINE.
3. Balance of competition (version one: small team; version two: big team): One of members in small team became lazy had more negative impact on team-competition than in big team. Therefore, we increased the amount of team members of version two to decrease the possibility of negative impact of lazy team members.
4. Level of cooperation (version one: semi-mandatory; version two: mandatory): Both games included prosocial rewarding to promote cooperation between team members. In game of version one, players could choose to gain additional scores by themselves or pass game hints to teammate. About one-third players tended to gain additional scores by themselves due to the distrust of others, so the cooperation didn't always happen. Therefore, in version two, we modified the cooperation mechanism, and players could only get bonus to cooperating with others.

## Experiment and Discussion

In game of version one, 23 participants were recruited among yoga club in college, while 19 participants were in new one, and 5 in both games. Participants need to fill in life-record for getting the corresponding game points to play game. The average target behaviour achievement was 33%. After four weeks testing of each game version, we had a 30 minutes face-to-face interview for every participant, in which we summaried four suggestions of game design factors for persuasive cooperative game.

Adjunct Proceedings of the
12th International Conference on Persuasive Technology, April 3-6, 2017, Amsterdam, The Netherlands.

1. Granularity of leaderboard: We found that members would compare with those familiar with and that healthy competition happened because of intra-team ranking. The users indicated: "*My position on leaderboard could create the feeling to me of being needed by my team.*" and "*I would notice the score of teammate who I care about. When exceeding him, I was very exciting."* Both of the feedbacks showed the intra-team ranking system would gain intrinsic motivation.
2. Communication channel: By adding a daily used channel, players had a stronger sense of community (SOC)[6]. "*After using this channel, I started to have conversation with others and thought knowing teammate had a deep impact on me.*" and "*At first, I wasn't interested in playing games, but knowing teammates let me feel stronger obligation of the team.*", said by users. By SOC[6], player had more obligation and achieved effect of motivation, which was the same result as Blanchard's research[6].
3. Balance of competition: The more engaged members in a team would reduce the influence of lazy player quitting game. "*In game of version one, a member quitted the game would lower my willingness of playing game, which finally became a vicious circle*", said by a player. Besides, there was a reversal of ranking in a week which players had deep impression on during experiment. After that, the team which was reversed increased their coherence and participation of teammates. According to feedback of users, we suggested the design of increasing possibility of reversal on team-competition to increasing team coherence.
4. Level of cooperation: Some users thought: "*I almost gained additional scores by myself in old game, but now I felt the cooperation between members so the motivation and enjoyment of playing games was promoted.*" The result is the same as Beznosyk's research[7] which presented "complementary" was one of the most enjoyable design pattern about collaboration.

## Acknowledgments

This research was supported in part by the Ministry of Science and Technology of Taiwan (MOST 105-2627-E-002-003), National Taiwan University (NTU-ERP-104R8951).

## Reference

1. Lin, J.J., Mamykina, L., Lindtner, S., Delajoux, G., Strub, H.B.: Fish'n'Steps: Encouraging physical activity with an interactive computer game. In: UbiComp 2006
2. Paavilainen, J.: Critical review on video game evaluation heuristics: social games perspective. In: Proc. of International Academic Conference on the Future of Game Design and Technology 2010
3. Campbell, T., Ngo, B., Fogarty, J.: Game design principles in everyday fitness applications. In: Proc. of Computer supported cooperative work 2008
4. Seif El-Nasr, M., Aghabeigi, B., Milam, D., Erfani, M., Lameman, B., Maygoli, H., Mah, S.: Understanding and evaluating cooperative games. In: Proc. of CHI 2010
5. Chen, Y.X., Han, P.H., Lin, H.C., Hung, Y.P.: Development of a Social Game Module to Enhance Usability of Healthy Behavior Persuasion System. In: Proc. of CGAT 2016
6. Blanchard, A.L., Markus, M.L.: The experienced sense of a virtual community: Characteristics and processes. In: ACM Sigmis Database 2004
7. Beznosyk, A., Quax, P., Coninx, K., Lamotte, W.: The influence of cooperative game design patterns for remote play on player experience. In: Proc. of Asia pacific CHI 2012

# Persuasive Dialogue System for Energy Conservation

Jean-Baptiste Corrégé[1], Céline Clavel[1], Nicolas Sabouret[1], Emmanuel Hadoux[2], Anthony Hunter[2], & Mehdi Ammi[1]

[1]LIMSI, CNRS, Université Paris-Saclay, F-91405 Orsay, France
[2]Department of Computer Science, University College London, London, UK
✉ jean-baptiste.correge@limsi.fr

## Introduction

In order to design dialogue systems dedicated to promote energy conservation, we consider ways to shape the system's arguments in the most persuasive way possible [5]. One such way could be through framing the information in order to make it more easily processed by the system's users [10].

## Related Work

The messages might be framed according to their emotional valence [1]. Emotions are of special interest because they affect not only what people think (their mood or the way they feel), but also how they think (cognition itself). Indeed, emotions arise from patterns of judgments made by individuals in reaction to their environment and the relationship they have with it, or appraisals [6]. According to [8], these appraisals are based on several checks related not only to the stimuli but also to the self: relevance (novelty, pleasantness, goal relevance), implication (causal attribution, outcome probability, discrepancy from expectation, goal/need conduciveness, urgency), coping potential (control, power, adjustment), and normative significance (internal standards, external standards). Consequently, different patterns of appraisal generate different cognitive responses and coping strategies. These strategies are either problem-focused (i.e. change the situation itself) or emotion-focused (i.e. change the relation to the situation; [9]. Thus, different information are processed more or less efficiently according to the coping strategies set up [3]. For example, guilt leads to problem-focused strategies, because it is associated with an error that has been made and a will to repair the wrong made. On the contrary, shame leads to emotion-focused strategies, because it is associated with negative implications for one's self-esteem and a perceived lack of capacity to change the environment. Consequently, a positively-framed message associated with guilt ("What you have to gain by drinking responsibly") is processed more fluently than a negatively-framed message associated with guilt ("What you have to lose by not drinking responsibly"). Conversely, the same positively-framed message is processed less fluently when associated with shame than the same negatively-framed message. Thus, by varying emotional valence and message-framing, one could improve a speech's impact on their conversation partner.

Another interesting lead could be to assess user's personality. Traits like regulatory focus [4], for example, have been shown to influence directly how individuals make judgements and decisions [2]. Individuals are generally either promotion-focused (i.e. gain-oriented, and seeking to achieve opportunities) or prevention-focused (i.e. loss-oriented, and seeking to avoid failures) and make decisions accordingly. For example, promotion-focused individuals are more receptive to promotion-focused information and vice versa. Similarly to what has been demonstrated with coping strategies, framing influences individual's cognitive processing of the messages [7]. Specifically, a promotion-focused individual will process faster a message emphasizing positive aspects of a product and possible gains associated with it ("This juice contributes to the creation of greater energy"), while a prevention-focused individual will process faster a message emphasizing aspects that would prevent them from possible losses ("This juice contributes to healthy cardiovascular function."). This increased fluency has a direct impact on individuals' preferences and decisions [7].

Adjunct Proceedings of the
12th International Conference on Persuasive Technology, April 3-6, 2017, Amsterdam, The Netherlands.

## Study

Because promotion-focused individuals are more sensitive to gains and prevention-focused individuals are more sensitive to losses, it might be very possible that the emotional valence (pleasant vs. unpleasant) could moderates the influence of gain/loss framing in a way that has not yet been investigated. In order to assess this potential influence, we propose an exploratory study to compare different framing configurations. Specifically, we propose to develop a 2 (valence framing of the speech: pleasant vs. unpleasant) x 2 (framing of the messages: gain vs. loss) experimental design. Such a study could be designed as an online investigation divided into the following steps: it is first necessary to evaluate participants' regulatory focus, attitude towards environment and current emotional state. Once it is done, they are proposed a short speech promoting the behavior. Then, participants' intention to perform the behavior is assessed before finally evaluating again their emotional state in order to check if the message had an effect.

The content of the speech would vary according to the experimental condition and could include messages such as:

- Saving energy today will save polar bears (positive valence and framing)
- Saving energy today will allow polar bears not to die (positive valence and negative framing)
- Wasting energy today kills polar bears (negative valence and positive framing)
- Wasting energy today will not allow to spare polar bears (negative valence and negative framing)

Results could allow to evaluate relative impact of the couples' influence on judgement and intention to perform the advertised behavior. Moreover, questionnaires assessing personality would allow to further explore these effects by evaluating how emotion and personality interacts.

## Conclusion and Future Work

On the longer term, it is possible to consider a system which would autonomously either evaluate or prime a given emotion. Considering the fact that specific emotions are linked to specific attentional focus, the system could adapt the content and form of its speech accordingly in order to maximize its efficiency. Moreover, if such a system was able to evaluate and model user's personality, it would be able to adjust its speech and select arguments that are the most susceptible to be persuasive.

## References

1. Achar, C. et al.: What we feel and why we buy: the influence of emotions on consumer decision-making. Curr. Opin. Psychol. 10, 166–170 (2016).
2. Cesario, J. et al.: Regulatory Fit and Persuasion: Basic Principles and Remaining Questions. Soc. Personal. Psychol. Compass. 2, 1, 444–463 (2008).
3. Duhachek, A. et al.: Guilt versus shame: coping, fluency, and framing in the effectiveness of responsible drinking messages. J. Mark. Res. 49, 6, 928–941 (2012).
4. Higgins, E.T.: Beyond pleasure and pain. Am. Psychol. 52, 12, 1280 (1997).
5. Hunter, A.: Opportunities for Argument-Centric Persuasion in Behaviour Change. In: Proceedings of the 14th European Conference on Logics in Artificial Intelligence - Volume 8761. pp. 48–61 Springer-Verlag New York, Inc., New York, NY, USA (2014).
6. Lazarus, R.S.: Progress on a cognitive-motivational-relational theory of emotion. Am. Psychol. 46, 8, 819 (1991).
7. Lee, A.Y., Aaker, J.L.: Bringing the Frame Into Focus: The Influence of Regulatory Fit on Processing Fluency and Persuasion. J. Pers. Soc. Psychol. 86, 2, 205–218 (2004).
8. Scherer, K., R.: Appraisal considered as a process of multilevel sequential checking. Apprais. Process. Emot. Theory Methods Reasearch. 92, 120, 57 (2001).
9. Smith, C.A., Kirby, L.D.: Putting appraisal in context: Toward a relational model of appraisal and emotion. Cogn. Emot. 23, 7, 1352–1372 (2009).
10. Tversky, A., Kahneman, D.: The framing of decisions and the psychology of choice. Science. 211, 4481, 453–458 (1981).

# Exploratory Evaluation of Motivational Text Messages Tailored to Stage and Personality

Roelof Anne Jelle de Vries, Randy Klaassen, Bryan Oostra, Jan Ubbo van Baardewijk, Thomas Brus, & Tiziana Guastamacchia

University of Twente, Enschede, The Netherlands
✉ r.a.j.devries@utwente.nl

## Introduction

Researchers are increasingly designing technologies and applications supporting people in changing their exercise behavior [2]. However, designing applications that effectively motivate someone to exercise, is challenging. Some answers that have been offered to increase the effectiveness of the exercise applications are: grounding the motivational strategies used in the application in existing behavior change theories or models [3], and tailoring the strategies used in the application to certain characteristics of the user [4].

In previous work [7] we found that the user characteristic personality influences the perception of the behavior change strategies from the Transtheoretical Model (TTM) [6]: the processes of change. In subsequent work [8], we have operationalized these strategies (the processes) through a crowdsourcing survey, where we collected motivational text messages designed for all the stages of change from the TTM. Through coding [8], we aligned these text messages to the ten processes of change from the TTM. In a subsequent survey, we evaluated five representative messages for each of the ten processes on how motivating they are perceived and measured the personality of each of the participants.

In this pilot study, we explored whether participants receiving, through an application on their smartphone, motivational text messages that represent the processes matched to the stage of the participant and tailored to their personality, are evaluated more motivating by the participants than receiving random motivational text messages that represent the processes.

## Method

***Setup*** We designed an in-the-wild pilot study in which participants installed an application that randomly assigned them to either the control condition or the tailored condition. We developed a smartphone application that sent text messages in the form of standard Android notifications. The application was as nonintrusive as possible, only interacting by sending notifications in the form of motivational messages (e.g., “Exercise will help clear your mind and reduce stress.”). In both conditions, people received three messages a day and used the application for three days. In previous work, [8] we evaluated 50 text messages, five for each of the ten processes of change. For this study, we extended this to a total of a 100 messages, ten for each of the processes. Through convenience sampling, 12 people participated in the experiment: 7 in the control condition (mean age = 22.1; SD = 2.9; 6 males), who rated a total of 62 messages (7x9 with 1 message unrated) and 5 participants in the tailored condition (mean age = 22.6; SD = 2.1; 3 males) who rated a total of 45 messages.

***Conditions*** Participants in the control condition randomly received one of the 100 messages, irrespectively of what category (process) the message was from. Participants in the tailored condition received a message selected from the subset of categories (processes) that matched their stage, and the probability of the categories was adjusted to each individual participant’s personality. This was based on the categories’ relation to personality from previous survey data [8], evaluating the message categories ratings on median-split personality trait scores.

***Procedure and evaluation*** After installing the application, participants were asked to fill in a 10-item personality questionnaire [1] and single item stage of change question [5]. During the experiment. participants received messages in daily life at the hours of 08:00, 14:00 and 19:00 and were instructed to read the messages and decide whether these messages made them 'more motivated!' to participate in exercise or if there was 'no change'.

## Results

Out of 62 messages sent in the control condition, 15 were rated as making the participants 'more motivated' (24.2%). Out of 45 messages sent in the tailored condition, 23 were rated as making the participants 'more motivated' (51.1%). A chi-square analysis showed this difference is significant ($\chi^2(1) = 8.249$; $p = .007$). Our results show that our tailored messages were considered significantly more motivating than our random messages.

## Conclusion

Our preliminary findings show that sending text messages representing the processes of change in-the-wild can be more motivational when tailored to stage and personality.

## References

1. Gosling SD, Rentfrow PJ, Swann WB, Jr (2003) A Very Brief Measure of the Big Five Personality Domains. Journal of Research in Personality, 37, pp 504-528
2. Hekler EB, Klasnja P, Froehlich JE, Buman MP (2013) Mind the theoretical gap: interpreting, using, and developing behavioral theory in hci research. In: CHI, ACM, pp 3307–3316
3. Michie S, Johnston M, Francis J, Hardeman W, Eccles M (2008) From Theory to Intervention: Mapping Theoretically Derived Behavioural Determinants to Behaviour Change Techniques. Applied Psychology 57(4):660–680
4. Noar SM, Benac CN, Harris MS (2007) Does tailoring matter? meta-analytic review of tailored print health behavior change interventions. Psychological bulletin 133(4): pp 673–693
5. Norman G, Benisovich S, Nigg C, Rossi J (1998) Examining three exercise staging algorithms in two samples. In: 19th annual meeting of the Society of Behavioral Medicine.
6. Prochaska JO, DiClemente CC (1983) Stages and processes of self-change of smoking: toward an integrative model of change. Journal of consulting and clinical psychology 51(3): pp 390
7. De Vries RAJ, Truong KP, Evers V (2016) Crowd-designed motivation: Combining personality and the transtheoretical model. In: Persuasive Technology, Springer, pp 41–52
8. De Vries RAJ, Truong KP, Kwint S, Drossaert CHC, Evers V (2016) Crowd-designed motivation: Motivational messages for exercise adherence based on behavior change theory. In: CHI, ACM, pp 297–308

# Virtual reality social skills training system: self-experiences with virtual cognitions in the context of negotiation training

Ding Ding[1], Willem-Paul Brinkman[1], & Mark A. Neerincx[1,2]

[1]Delft University of Technology, The Netherlands
[2]TNO, The Netherlands
✉ {d.ding-1, w.p.brinkman, m.a.neerincx}@tudelft.nl

## Introduction

Social skills play an increasingly important role in everyday interactions as they affect our ability to function in our daily life. However, according to a survey [1] from 2012, 42 percent of 1,021 technology stakeholders and critics believe that by 2020 people will lack face-to-face social skills. Therefore, social skills training systems are developed to improve people's performance in social interactions. Recently, virtual reality technologies have attracted particular attention and have proven effective in improving social skills [2]. Nevertheless, the focus has been mainly on the competence itself while other important aspects have not received much attention. We posit that two elements can be improved. First, the training systems should provide the user with reasons for the behavior suggestions that they make, because research in the field of learning has demonstrated that thoughtful and timely guidance is vital for the effectiveness of the learning experience [3]. Secondly little consideration is given to the individual's motivation and willingness to engage in social interaction. According to Bandura [4], however, people's beliefs about their capabilities, i.e. their self-efficacy, determine how they feel, think, behave and motivate themselves to engage in social interactions. Therefore, in addition to exposing people to a virtual environment, the next step is to expose people to virtual cognitions aimed at altering their beliefs and changing their behaviour. Virtual cognitions are realized as a set of pre-recorded voice-overs that provide understandable guided learning, timely reflection and motivating statements.

## System

Our training system is an immersive virtual reality training system in which users explore a passive virtual self-experience in the context of negotiation. Users are represented by a doppelganger (virtual-self) in the virtual environment. They are immersed in this environment via a head-mounted dis-play (HMD), and with their body motion captured by a Kinect. During the training, users do not actually negotiate with the other party but have a vicarious experience, passively observing themselves interacting with virtual humans from a first person perspective and simultaneously hearing the virtual cognitions. Virtual cognitions consist of the knowledge and strategies of social skills, reflection, and self-motivating statements. These cognitions work as an internalized coach or expert who provides the guided learning and encouragement tailored to the individual during the whole training. For tailoring, we created a database that includes three types of data and information: negotiation knowledge and strategies, personal information and experience collected from users, scenario and events information from the virtual environment.

To date, our training system consists of three training sessions, each containing one negotiation scenario with different workplace topics, i.e. being late for work, demanding a holiday and quitting their job. In each scenario, the users play the role of an employer negotiating with an employee which is represented by a virtual avatar. In the next step, we intend to work on adaptive control strategies to provide more effective and acceptable virtual cognitions.

## References

1. Anderson, J.Q. and L. Rainie, *Millennials will benefit and suffer due to their hyperconnected lives.* Future of Higher Education, 2012.
2. Broekens, J., et al. *Virtual reality negotiation training increases negotiation knowledge and skill*. in *intelligent virtual agents*. 2012.

3. Core, M.G., et al., *Teaching Negotiation Skills through Practice and Reflection with Virtual Humans.* Simulation, 2006. **82**(11): p. 685-701.
4. Bandura, A., *Self-efficacy: The exercise of control.* Journal of Cognitive Psychotherapy, 1997. **604**(2): p. 158-166.

# Does Beauty Matter in Behavior Change?

Lígia Duro[1,3], Evangelos Karapanos[2], Teresa Romão[3], & Pedro Campos[1]

[1]Madeira Interactive Technologies Institute, Funchal, Portugal
[2]Persuasive Technologies Lab, Cyprus University of Technology, Limassol, Cyprus
[3]NOVA LINCS, Faculdade de Ciência de Tecnologia, U. NOVA de Lisboa, Caparica, Portugal
✉ ligiaduro@gmail.com

## Introduction and Hypothesis

Empirical research confirms what graphic designers claim from their experience [1]: typefaces and color variations can invoke different impressions about a product or message being presented [3]. Typefaces, for instance, can even affect how much effort a task would require [5]. In a study of Song and Schwarz [5], participants read identical instructions for an exercise routine in different typefaces, in an easy-to-read (Arial, 12 points) or a difficult-to-read (Brush, 12 points) condition. The participants who read the text in a difficult-to-read condition estimated that the exercise would take more time and exhibited lower willingness to make the exercise part of their daily routine, than those who read the text in the easy-to-read condition. Simply varying typefaces and color schemes of the background and text color is expected to influence individuals' behavioral intention and willingness to engage in behavior change.

We suggest that perceived beautiful textual presentations, with a high processing fluency, should increase individuals' motivational power through two different paths, depending on the primary motivation of individuals, being extrinsic or intrinsic. The first path suggests that beauty elicits positive emotional responses [6] which, in turn, can affect our cognitive processing as well as our intrinsic motivation for the activity, as long as the activity is intrinsically motivating for the individual [2]. In this sense, beauty, through positive affect, is expected to momentarily activate individuals' intrinsic motivation for the activity. The second path suggests that beauty motivates by acting as a peripheral cue. The Elaboration Likelihood Model [4] states that the extend to which we will cognitively process a message depends on how motivated we are to do this (i.e., how relevant the information is to us) and our ability to think about the arguments (e.g., the message's comprehensibility). If individuals are motivated and have the ability to process the message they will process it through the central route. If individuals are not motivated or do not have the ability to process the message they are more likely to be influenced by aspects which have nothing to do with the message arguments, and thus elaborate the message through the peripheral route [4]. As motivation and ability to process the arguments of a message decrease, peripheral cues become relatively more important factors of persuasion [4]. As such, when individuals' are primarily extrinsically motivated to do an activity, beauty might serve as a positive peripheral cue to process the message. If that message is able to induce positive affect, it should increase message persuasion (affecting directly attitudes) and consequently increase the behavioral intention towards the activity.

## Future Research

In this paper, we suggest that beauty can heighten behavioral intentions and the willingness to engage in behavior change, through two different paths, depending on being extrinsic or intrinsic motivated. Both paths share a common denominator: the mediating role of positive affect. Our current work seeks to design an experimental study that will test these hypotheses. We have designed motivational textual messages of varying aesthetic value through varying typeface families (Handwriting, Serif, and Sans serif) and background and text color (warm and cold colors).

## Acknowledgments

This research was funded by ARDITI – Agência Regional para o Desenvolvimento da Investigação Tecnológica e Inovação, Madeira Island, Portugal, under the support of the Project M1420 - 09-5369-FSE-000001 – Ph.D. scholarship.

## References

1. Hyndman, S.: Why fonts matter. Virgin Books (2016).
2. Isen, A.M., Reeve, J.: The Influence of Positive Affect on Intrinsic and Extrinsic Motivation: Facilitating Enjoyment of Play, Responsible Work Behavior, and Self-Control. Motiv. Emot. 29, 4, 295–323 (2005).
3. Karnal, N. et al.: Healthy by design, but only when in focus: Communicating non-verbal health cues through symbolic meaning in packaging. Food Qual. Prefer. 52, (2016).
4. Petty, R.E., Cacioppo, J.T.: Communication and persuasion : central and peripheral routes to attitude change. Springer-Verlag, New York (1986).
5. Song, H., Schwarz, N.: If it's hard to read, it's hard to do: Processing fluency affects effort prediction and motivation. Psychol. Sci. 19, 10, 986–988 (2008).
6. Yeh, Y. Chu et al.: Associated and dissociated neural substrates of aesthetic judgment and aesthetic emotion during the appreciation of everyday designed products. Neuropsychologia. 73, 151–160 (2015).

# Inter-disciplinary and -sectorial cooperation for development of technology supporting behavioral change

Maria Ehn[1], Mattias Derneborg[2], Martin Ekström[1], & Ann-Christin Johansson[3]

[1]School of Innovation, Design and Engineering, Mälardalen University, Västerås, Sweden
[2]Centre for health care, Västmanland County Council, Västerås, Sweden
[3]School of Health, Care and Social Welfare, Mälardalens Högskola, Västerås, Sweden
✉ maria.ehn@mdh.se, mattias.derneborg@regionvastmanland.se, martin.ekstrom@mdh.se, ann-christin.johansson@mdh.se

## Introduction

Life style related health conditions are gaining importance in the global growth and economy development scenario. Indeed, small changes in health behaviours can result in major effect sizes on these conditions [1]. By improving health habits, people can live longer and healthier lives, as well as retard the process of ageing [2]. Therefore, a future challenge for health care is to promote healthy behaviours for the growing older population. Injuries related to falls are a main cause for decreased health and independence of seniors. Training of strength, balance and endurance can prevent approximately 40% of all fall accidents [3]. Specific programs containing training exercises fall prevention have been developed and proven to be efficient for preventing falls and fall related injuries [4]. The challenge is to motivate and support older people to increase their fall preventive physical activity in a long-term perspective. Supporting technology can contribute here

## Method

The project is organised into four work packages, WPs:
WP1 (Analysis) aims at analysing needs and requirements from both users (seniors and health care professionals) and market (including legislation). Collection of user needs will be performed through focus group interviews, one with seniors and one with personnel from county council- and municipality health care organizations. Collection of needs related to market and legislation will be performed through interviews with key persons from municipality and county council. WP1 also includes analysis of market and potential collaboration partners.
WP2 (Requirements specification) aims at analysing and compiling requirements from WP1 into a requirements specification.
WP3 (Technical specification) aims at specifying the outline and technical content of a solution fulfilling the requirements compiled in WP2.
WP4 (Preparations for user-driven development of the technical solution) aims at preparing for future user-driven development and testing of the technology. Here a project plan for the process will be developed and the consortium will be developed in order to include essential partners in the future development and implementation of the solution.

## Project organization

The project is organization is organised into the three projects (User perspective, Implementation and Technology respectively) led by a sub-project manager with extensive knowledge in the specific area. Project partners participate in one or two subprojects. In order to strengthen the users influence on the project, a user forum has been established including regional organizations representing seniors and operations promoting seniors' physical activity. Its role is to give feedback on the project and the idea to solution from the seniors' perspective. Moreover, the organizations are important ways of reaching out to larger groups of users. A reference group will be formed with the role of assessing the idea to technical concept from several perspectives. Invited organizations include national senior organizations as well as national agencies on Medical products and Civil Contingency, the national association for Medical Technology and the national board of Health and Welfare

## References

1. Dean et al 2011. The first physical therapy summit on global health: Implications and Recommendations for the 21st century. *Physiotherapy Theory and Practice* **27**(8): 531-547.)
2. Bandura, A. 2004. Health promotion by social cognitive means. *Health Education & Behaviour* Vol **31**(2): 143-164).
3. Gillespie et.al 2009. *Cochrane Database Syst Rev* **15**(2): CD007146
4. Thomas, S., et al. (2010). "Does the 'Otago exercise programme' reduce mortality and falls in older adults?: a systematic review and meta-analysis." *Age and Ageing* **39**(6): 681-687.

# Human Centred Design of a blended learning course supported by persuasive technology: Autobiographical reflection for social work students

Monique M.J. Engelbertink[1] , Saskia M. Kelders[2], Kariene M. Woudt-Mittendorff[1], & Gerben J. Westerhof[2]

[1]Saxion University of Applied Sciences; Enschede; The Netherlands
[2]University of Twente, Enschede, The Netherlands
✉ m.m.j.engelbertink@saxion.nl; s.m.kelders@utwente.nl; k.m.mittendorff@saxion.nl; g.j.westerhof@utwente.nl

## Background

This poster presents the use of a human-centred design to optimise the use of persuasive technology in an engaged blended learning environment. The context of this blended learning course is autobiographical reflection by second year social work students (bachelor's degree level). This autobiographical reflection course is the subject of a larger study on promoting the professional identity of social work students.

The design and use of persuasive technology that promotes an engaged blended learning environment involves two challenges: engagement of students and the role of the teacher. We address both points. Firstly, students need to engage with the online environment (1–3), which can be problematic. Bernard et al. (3) describe three areas that have to be explored and developed in the design of blended learning to enhance engagement: 1) self-regulation of students; 2) motivational design; 3) collaborative and cooperative learning.

These three areas come together in the Persuasive Systems Design Model (PSD model; (4). Persuasive technology can be used to influence the behaviours and attitudes of people. The second challenge presented by blended learning is the teachers' role (2,5–7). The use of homework or tutorials in combination with face-to-face classes (FTFC) is not new for teachers, but using online components certainly is. Teachers have to become familiar with new technologies, including Learning Management Systems (LMS). Teaching a blended course can make them insecure about their professionality (6). Therefore, it is important that the teacher prepares each online course well and feels familiar with its techniques. Such preparation will also lead to increased student engagement (2). When a teacher moderates the students' postings and assists the students online, this will also stimulate the students' online learning process (2,7). The level of interactions between students is strongly correlated with higher grades for that specific course. Thus, the teaching strategy has to stress the value of interactions between students online (7).

The main question is how blended learning supported by persuasive technology can be designed to increase the engagement of students and teachers? There are two sub-questions to address: Which persuasive technology strategies of the PSD model are most suitable for the method of autobiographical reflection for second year social work students?; What should be the role of the teacher in aligning FTFC with the online course to create optimal opportunities for blended learning?

## Methods

A human-centred design was used: during 6 months a group of 17 teachers, ICT specialists, social workers and students gave input and feedback on the blended learning course 'autobiographic writing' supported by persuasive technology (based upon (8)). Two pilots were held among students and evaluated using interviews, focus groups and a questionnaire.

## Findings

Across the phases of the design, three categories of the PSD model, 'primary task support', 'dialogue support' and 'system credibility' were favoured by the social workers, teachers and students. In general, the category 'social support' was found to conflict with the process of autobiographic writing because of its personal nature. Of this category, only the technique 'social learning' could me more integrated in the online course. There could be a more active online platform in Black Board to

support the students. But teachers and students don't find Black Board user-friendly and sometimes teachers don't have time to read all the input of the students. Based on the first design phase, an instruction was made for teachers to make a systematic integration of the online course with their FTFC. During the FTFC, teachers are looking for ways to motivate students without checking them.

## Discussion

The human-centred design process and the PSD model has yielded useful input on how to design the blended learning course. Particular challenges for this course are how to organize the social support between students and teachers as well as the support of professionals in integrating the online environment into their face-to-face classes.

## References

1. Van Gemert-Pijnen JEWC, Kelders SM, Bohlmeijer ET. Understanding the usage of content in a mental health intervention for depression: An analysis of log data. J Med Internet Res [Internet]. 2014 Jan [cited 2014 Oct 6];16(1):e27. Available from: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3936274&tool=pmcentrez&rendertype=abstract
2. Ma J, Han X, Yang J, Cheng J. Examining the necessary condition for engagement in an online learning environment based on learning analytics approach: The role of the instructor. Internet High Educ. 2015;24:26–34.
3. Bernard RM, Borokhovski E, Schmid RF, Tamim RM, Abrami PC. A meta-analysis of blended learning and technology use in higher education: from the general to the applied. J Comput High Educ [Internet]. 2014 Apr 9;26(1):87–122. Available from: http://link.springer.com/10.1007/s12528-013-9077-3
4. Oinas Kukkonen H, Harjumaa M. Communications of the Association for Information Systems Persuasive Systems Design : Key Issues , Process Model, and System Features. Design. 2009;24(Article 28):485–500.
5. Lam J. The context of blended learning: The TIPS blended learning model. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics). 2014. p. 80–92.
6. Shelley M, Murphy L, White CJ. Language teacher development in a narrative frame: The transition from classroom to distance and blended settings. System [Internet]. Elsevier Ltd; 2013;41(3):560–74. Available from: http://dx.doi.org/10.1016/j.system.2013.06.002
7. Ginns P, Ellis R. Quality in blended learning: Exploring the relationships between on-line and face-to-face teaching and learning. Internet High Educ. 2007;10(1):53–64.
8. Bohlmeijer ET, Westerhof GJ. Op verhaal komen, je autobiografie als bron van wijsheid. Uitgeverij Boom; 2010.

# Towards a Faster Sustainable Behavior Change at Office Workplaces: Exploiting the Periphery of Attention as a Persuasive Strategy

Nelly Condori Fernandez[1] & Alejandro Catala[2]

[1]VU University Amsterdam, The Netherlands
[2]University of Twente, The Netherlands
✉ n.condori-fernandez@vu.nl, a.catala@utwente.nl

## Introduction

Social sustainability guides the social, cultural, and diversity practices that create a positive environment in which to work and live [7]. And as ICT has a big impact on societies and can fundamentally transform societies and individual lives, it is of importance for IT organizations to consider the sustainable development, particularly the social dimension, in their business model.

Although majority of SME organizations are yet struggling to understand how sustainability can be involved in their business strategy and practices, leading organizations recognise that social aspects are just as important to long-term success as economic aspects. Particular focus is given to the labour conditions for reducing risks associated with work-related stress and musculo-skeletal injuries from workplace.

According to Smith [6], among the different interventions that can be implemented in the workplace for reducing or preventing the RSI (Repetitive Strain Injury), carrying out exercises and physical conditioning have shown to have positive effects. In this respect, there exists some software applications which aim to prevent and reduce RSIs (see [5]).

A popular and freely available good example for desktop computers is Workrave[1], which considers micro-pauses, rest breaks, and guidance for exercise routines. This kind of software is based on timers and keyboard/mouse activity, which determine when the actions must displayed on screen. Sometimes, these interruptions may not be welcomed or accepted by users, who after skipping several software's requests will eventually receive annoying responses (e.g. sudden and strong beeps). This lack of gentle persuasiveness, the lack of context-awareness by the computer on whether it would be appropriate to interrupt an on-going activity regardless of its nature, along with abruptly implemented requests can likely lead users to give up the prevention program.

## Holistic approach to encourage sustainable behaviour at workplace.

For the aforementioned reasons, and with the purpose of encouraging a sustainable behaviour at workplace, we propose in our research a holistic approach, which aim to develop a context-aware software system for delivering adaptive persuasive suggestions/messages to enhance/prevent RSI.

Our context-awareness approach uses i) unobtrusive monitoring technology to incorporate also emotional information derived from physiological data; ii) routine adaptation considers a task ontology, and iii) persuasion principles from Cialdini et al [2] to investigate the appropriateness and level of persuasiveness suggestions/feedback by considering the user behaviour (e.g. emotions).

Furthermore, in this proposal we consider to bring the persuasive strategy outside the computer, implemented in a physical robot. This idea arises as a result of running some experimental studies, where we observed that the same delivered persuasive messages had some positive/negative effects on the user experience depending on the context. For instance, some participants get scared when the mobile application rendered the first persuasive message

[1] Workrave website: http://www.workrave.org/

because it caught these users off his/her guard, or they may get really annoyed if their task was abruptly interrupted.
The purpose of this shift, towards the periphery of attention in the form of a robot, is also motivated by the opportunities that peripheral interaction [1] can offer to implement subtle and progressive changes in the workplace environment that invite to follow the routines with higher level of acceptance and persuasiveness, and the positive effect that embodied entities can have [4].

The architecture of our approach is based on [7], which has been expanded by adding the peripheral interaction design space. It includes an actuation layer responsible to first decide the most suitable format of the persuasive message at every moment, and deliver it using the output devices available such as the computer screen, peripheral tablets, or a robot depending on the context.
Through this research work we aim to answer the following research question: Can the persuasive strategy be more effective when a context-aware system is enriched with a peripheral interaction design space?
Thus, one of the key aspects in this on-going research is which design elements should be included in such space and how they should be actuated according to the contextual information (e.g. emotion state, user profile, task profile).

Currently, a first prototype of the persuasive software system without peripheral interaction features is being tested and evaluated by using the framework ProSPer [3], as well as identifying potential situations where we could add these design elements.

## References

1. Bakker, S., Hausen, D., Selker, T.: Introduction: Framing Peripheral Interaction, Peripheral Interaction. pp. 1-10. Springer International Publishing (2016).
2. Cialdini, R.: Influence: science and practice. Boston, MA: Allyn and Bacon, 2001.
3. Fenicio, A., Calvary, G., Laurillau, Y., Vanderdonckt, J.: ProSPer: modeling the change, driving the persuasion. In: Actes de la 28ième conférence francophone sur l'Interaction Homme-Machine (IHM '16), pp. 59-69 ACM, New York, NY, USA (2016).
4. Li, J.: The benefit of being physically present: A survey of experimental works comparing copresent robots, telepresent robots and virtual agents. International Journal of Human-Computer Studies, 77, 23-37 (May 2015), ISSN 1071-5819.
5. Morris, D., Bernheim Brush, A.J., Meyers, B.R.: SuperBreak: using interactivity to enhance ergonomic typing breaks. In: the SIGCHI Conference on Human Factors in Computing Systems (CHI 2008), pp. 1817-1826. ACM, New York, NY, USA (2008).
6. Smith, M.J., Karsh, B.-T., Moro, F.B.P.: A Review of Research on Interventions to Control Musculoskeletal Disorders. National Research Council (US) Steering Committee for the Workshop on Work-Related Musculoskeletal Injuries: The Research Base. Washington (DC): National Academies Press, US(1999).
7. Suni, F., Condori-Fernandez, N.: Design of an adaptive persuasive mobile application for stimulating the medication adherence. In: Intelligent Technologies for Interactive Entertainment. 8th International Conference INTETAIN 2016. Utrecht, The Netherlands. June 28-30 2016.
8. Vallance, S., Perkins, H.C., Dixon, J.E.: What is social sustainability? A clarification of concepts. Geoforum, 42, Issue 3, , 342-348 (June 2011), ISSN 0016-7185.

## Smartphone-based experience sampling in young adolescents: risk and protective factors of mental health in daily life

Nicole Gunther & Vivianne Thewissen

Faculty of Psychology and Educational Sciences, Open University, Heerlen, The Netherlands
✉ nicole.gunther@ou.nl

The mobile phone is increasingly becoming an integral part of the daily lives of people of all ages, and particularly of young people. In the Netherlands, about three-quarters of young adolescents aged 12-18 years use their smartphones to go online [1]. The uptake of smartphones in the general population of young adolescents has encouraged the development of apps used to facilitate real-time assessment in various situations of the youngsters' daily life. Although momentary assessment approaches have been increasingly applied over the last decades, the emergence of smartphone applications as a platform for momentary assessment greatly improved the acceptability and usability of this technology. Momentary assessment approaches, such as the Experience Sampling Method (ESM) [2] or Ecological Momentary Assessment (EMA) [3] arose from different research traditions, but both are suitable to study moods, thoughts, symptoms, behaviours and experiences of individuals in their day-to-day life. There are an abundance of ESM studies focusing on youngsters [for an overview, see 4], however, most of these studies used ESM paper-and pencil techniques. A recent study showed that EMA based on mobile technology offers high viability for measuring mental health states in adolescents [5]. Furthermore, a method measuring at unpredictable random times during the day, is preferable for assessing the dynamics of mental health states which are highly context-dependent and fluctuate throughout the day.

The Faculty of Psychology and Educational Sciences of the Open University of the Netherlands is planning to conduct several ESM studies in Dutch adolescents aged 12 to 19 years and attending secondary schools in the Netherlands. The main goal of these studies is to examine risk factors (such as high sensitivity to stress) and protective factors (such as high and stable self-esteem) related to mental health, thereby contributing to the advancement of knowledge of daily patterns associated with mental health in youth. These studies comprise an online baseline questionnaire and momentary assessments using a smartphone application. The online baseline questionnaire, in which demographic variables (such as sex, age, level of education), psychopathology, self-esteem, physical activity, sleep problems, resilience, pubertal development, (cognitive) coping, parenting styles and (cyber)bullying are measured, will be administered within three weeks before the start of the momentary assessments. Daily data will be collected by using an experience sampling smartphone app. The app is programmed to give a series of signals at random moments throughout the day over the course of several days. Immediately after each signal, the adolescents have to fill out a questionnaire on their smartphone about affect, self-esteem, loneliness, social contexts, locations, physical activity and substance use. In addition, every morning, adolescents have to answer questions about the quality of their sleep during the past night.

In conclusion, smartphone-based experience sampling will be used to assess and evaluate youngsters in their natural environment, adopting an idiographic perspective, and to identify risk and protective factors for youngsters' mental health.

### References

1. Central Bureau of Statistics (2014). Jongeren vooral online met smartphone. Accessed at January, 26, 2017, retrieved from https://www.cbs.nl/nl-nl/nieuws/2014/22/jongeren-vooral-online-met-smartphone
2. Hektner JM, Schmidt JA, Csikszentmihalyi M (2007) Experience Sampling Method: measuring the quality of everyday life. Thousand Oaks: Sage Publications.

3. Shiffman S, Stone AA, Hufford MR (2008) Ecological momentary assessment. Annu Rev Clin Psychol 4:1-32. doi:10.1146/annurev.clinpsy.3.022806
4. Mehl MR, Conner TS (2012). Handbook of research methods for studying daily life. New York, London: The Guilford Press.
5. Magallón-Neri E, Kirchner-Nebot T, Forns-Santacana M, Calderón C, Planellas I (2016) Ecological Momentary Assessment with smartphones for measuring mental health problems in adolescents. World J Psychiatr 6(3):303. doi:10.5498/wjp.v6.i3.303

# Understanding Motivations and Potential Persuasive Design Techniques for Older Adults' Physical Activity Behaviors

Christina N. Harrington[1], Sean A. McGlynn[1], & Wendy A. Rogers[2]

[1]Human Factors and Aging Laboratory Georgia Institute of Technology, Atlanta, GA, USA
[2]College of Applied Health Sciences, University of Illinois Urbana-Champaign, Champaign, IL, USA
✉ cnh@gatech.edu, smcglynn6@gatech.edu, wendyr@illinois.edu

## Introduction

Despite the well-documented positive correlation between physical activity and physical well-being [1,2], many adults do not meet the recommended levels of physical activity as outlined by the U.S. Federal Physical Activity guidelines [3,4]. Individuals abandon routine physical activity due to lack of knowledge of proper exercise regimens, access to facilities, or intrinsic or extrinsic motivation [5]. Persuasive technologies in the form of mobile health (mHealth) applications have the potential to promote physically activity, but these technologies are not frequently utilized long-term, thereby limiting potential health benefits [7,8,9]. Out of roughly 100,000 mHealth applications currently on the market, roughly 1/3 are abandoned after 6 months [10]. Many lack effective implementation of established theoretical constructs into their design, thus not addressing aspects of persuasion that have been proven to lead to behavior change (e.g., goal-setting, skill acquisition) [11]. As such, there is a need for an in-depth understanding of the constructs that encourage physical activity among older adults, and thus could potentially increase the use and overall effectiveness of mHealth applications.

As a theoretical basis, we utilize the Health Belief Model (HBM) [12] which frames self-efficacy, perceived barriers, benefits, and cues to a behavior as the key concepts to behavior adoption. Qualitative interviews were conducted to explore the key constructs associated with older adults initiating and sustaining recommended levels of physical activity, along with participants' method of goal-setting and progress-tracking. This qualitative analysis serves as the first study in a larger research effort which identifies prominent constructs associated with older adults engaging in physical activity, refine persuasive design principles based on these constructs, and then evaluate the effectiveness of these principles, when applied to mHealth applications, in successfully encouraging older adults to sustain physical activity levels.

## Study Design

Semi-structured interviews were conducted with 16 participants (8 male), age 65-84. Participants were recruited for two groups (frequent exercisers were those who exercised 4+ days a week and infrequent exercisers were those who exercised 2 days a week or less). Participants were interviewed to assess barriers and facilitators to engaging in and sustaining physical activity or exercise, as well as any internal or external motivators which influenced their engagement. Participants were asked to explain how they integrated physical activity into their everyday routine, and their preferences to workout in groups or alone. Additionally, each participant completed an Exercise Confidence Survey to assess situations that may deter self-efficacy in completing physical activity.

## Results

Inductive analysis was used to identify codes among these factors including 'Barriers/Facilitators to Physical Activity'; and 'Intrinsic/Extrinsic Motivators for Initial and Sustained Engagement in Physical Activity'. Results showed that there is a consistent prevalence of themes associated with the codes identified across both participant groups. Social support and self-efficacy were prominent themes reported as determinants of the likelihood to sustain recommended levels of physical activity. There was significant statistical difference between the extrinsic motivators for frequent and infrequent exercisers, with more than half (57%) of infrequent exercisers reporting primary motivation to sustain activity from outside

peers and friends, compared to 36% of frequent exercisers. The ability to customize one's workout was also found to be a prevalent theme associated with facilitators to being active, 60% of infrequent exercisers and 71% of frequent exercisers. Other notable results include media and advertising to be the most prevalent external motivator to become physically active, compared to previous research findings that attribute social influence.

## Discussion

Findings from this qualitative study identify key themes of barriers, facilitators, and motivators to physical activity and provide valuable insight into the variables that affect individual participant behaviours. Such findings suggest a need to refine persuasive design strategies that target the older adult population. Results of this analysis will be used to guide the refinement of existing persuasive design principles integrated into mHealth applications. Next steps of this research will refine existing persuasive design principles based on these constructs and outline a framework for persuasive design specifically targeting older adults.

## References

1. Bherer, L., Erickson, K.I., Liu-Ambrose, T. (2013). A review of the effects of physical activity and exercise on cognitive and brain functions in older adults. In Journal of Aging Research, 2013(9): 1-8.
2. Sherrington, C., Tiedemann, A., Fairhall, N., Close, J.C.T., Lord, S.R. (2011). Exercise to prevent falls in older adults: an updated meta-analysis and best practice recommendations. In New South Wales public health bulletin, 22(4): 78-83.
3. World Health Organization, 2010. Global Recommendations on Physical Activity for Health. http://whqlibdoc.who.int/publications/2010/978924 1599979_eng.pdf.
4. Behavioral Risk Factor Surveillance System Survey Data, 2008. Retrieved from: http://www.cdc.gov/nccdphp/dnpa/physical/stats/index.htm).
5. Klompstra, L., Jaarsma, T., Strömberg, A. (2014). Exergaming to increase the exercise capacity and daily physical activity in heart failure patients: a pilot study. In BMC geriatrics,14(1): 119-127.
6. Purpura, S., Schwanda, V., Williams, K., Stubler, W., Sengers, P.: Fit4life: the design of a persuasive technology promoting healthy behavior and ideal weight. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems 2011 May 7 (pp. 423-432). ACM.
7. Fritz, T., Huang, E.M., Murphy, G.C., Zimmermann, T.: Persuasive technology in the real world: a study of long-term use of activity sensing devices for fitness. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems 2014 Apr 26 (pp. 487-496). ACM.
8. Meyer, J., Schnauber, J., Heuten, W.: Long Term Use of Smart Health Devices for Supporting Healthy Living. In Alexander Meschtscherjakov Boris De Ruyter Verena Fuchsberger Martin Murer, 4:26 (2016).
9. Ledger, D., and McCaffrey, D.: Inside wearables: How the science of human behavior change offers the secret to long-term engagement. *Endeavour Partners, LLC 93*, 1 36–45, (2014).
10. Voth, E.C., Oelke, N.D., Jung, M.E.: A Theory-Based Exercise App to Enhance Exercise Adherence: A Pilot Study. In JMIR mHealth and uHealth, 4(2) (2016).
11. Hochbaum, G., Rosenstock, I., & Kegels, S. (1952). Health belief model. *United States Public Health Service*.

# Effects of Changing Feedback Focus in Physical Activity Applications on Users' Performance

Katja Herrmanny, Jürgen Ziegler, & Aysegül Dogangün

Personal Analytics, Interactive Systems Research Group, University of Duisburg-Essen, Duisburg, Germany
✉ katja.herrmanny@uni-due.de

## Motivation And State Of The Art

Goal-setting and feedback on goal achievement are important factors for persuasion of activity tracking applications [1,2,3,4]. Feedback has a motivating effect by showing to which degree a goal is achieved and allows people to adjust the level or direction of their effort or to adjust their performance strategies [3]. Different kinds of feedback presentation, e.g. using metaphors, have been investigated in the field of activity tracking [5,6,7]. However, feedback elements used in research and in applications on the market usually put the focus on achieved action. There is no rationale given as to why the focus is put on the completed part of the action. Research from other contexts than physical activity has shown that feedback focus is connected to motivation level [8,9,10]. Until half of the goal is achieved, it is generally beneficial to focus on the achieved action, afterwards on the missing action. Bonezzi et al. [8] argue that to-date framing (i.e. focusing on the achieved part) leads to a high initial motivation level which monotonically decreases during the goal attainment process. In contrast, in a to-go framing, motivation starts on a low level, but then increases. In order to guarantee the highest possible motivation level during the whole goal attainment process, the focus must be changed at the point of 50% of goal attainment. Koo and Fishbach's studies [9,10] show similar results. In line with the aforementioned work, they found that focusing on the smaller value leads to highest motivation. That's why they call their findings the 'small-area-hypothesis'.

If it is possible to transfer these findings to the context of physical activity applications, they could be valuable for designing motivating feedback elements. However, this has not yet been investigated. Therefore, we investigated the effects of feedback focus change in a step counter app conducting a comparative 12-week field study. Three versions were implemented and randomly assigned to subjects. They represented the following three study conditions: (1) condition to-date framing (TDF), (2) condition to-go framing (TGF), and (3) condition focus change (FC). Depending on the condition, textual and visual feedback emphasised the achieved action, the remaining action or changed from achieved to remaining when achieving 50% of the goal, which was 50000 steps per week in all conditions. Our hypotheses were: (1) goal achievement (number and level of achieved goals) will be higher in condition FC than in the other ones, and (2) in the FC condition goals will be achieved earlier than in the other ones.

## Field Study

After exclusions, 27 subjects and 141 weeks remained (TDF; 28 subjects, 25 weeks; TGF 31 subjects, 51 weeks; FC: 13 subjects, 65 weeks). From those who indicated their sex and age, 27 were male and 40 female, and the mean age was 47 years (SD = 15.18).

As in the underlying work [9,10], we used goal achievement as an indicator for motivation. In our study, the set goal was achieved in 80 of 141 cases (56.738%). In condition FC, 68% of all goals were achieved. Goals were less often achieved in conditions TDF (51%) and TGF (57%). These differences are not significant according to a performed $\chi^2$ test. Investigating the level of goal achievement, lowest mean step counts were found in condition TDF (M = 5232, SD = 17507), followed by FC (M = 56713, SD = 16668) and TGF (M = 58613, SD = 20577). As [9,10] did, we also used the duration until goal attainment as an indicator for motivation. 80 weeks (those in which the goal was achieved) were included (TDF: n = 26, TGF: n = 37, FC: n = 17). In condition TDF goals were reached on average after 5.96 days (SD = 1.08) and in condition TGF after 5.43 days (SD = 1.19). FC group had the shortest mean duration (M = 5.41

days, SD = .795) until goal attainment. A Kruskal-Wallis-H-Test showed a significant result on a 90% significance level ($\chi 2(2) = 4.85$, $p = .089$). Post-hoc test revealed significant differences between TDF und TGF ($p = .069$) and between TDF and FC ($p = .043$).

## Discussion

Results indicate that feedback focus might have the potential to influence motivation and performance in activity tracking apps. Although significant only in some of the calculations, it is notable that a focus on achieved action – the one mostly used in practice – leads to worst results. In contrast, we found most promising results, however only descriptive, for changing focus feedback. A possible reason for missing statistical significance might be the high inter- and intra-personal variance of performance, which is typical for the field of physical activity. Our work suggests that it might be valuable to consider the focus when designing feedback elements in activity tracking apps. This approach deserves further investigation and results should be analysed considering potential moderating variables.

## References

1. Erez, M.: Feedback. A necessary condition for the goal setting-performance relationship. Journal of Applied Psychology. 62 (5), 624–627 (1977)
2. Becker, L.J.: Joint effect of feedback and goal setting on performance. A field study of residential energy conservation. Journal of Applied Psychology 63 (4), 428–433 (1978)
3. Locke, E.A., Latham, G.P.: Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. American Psychologist 57 (9), 705–717 (2002)
4. Bort-Roig, J., Gilson, N.D., Puig-Ribera, A., Contreras, R.S., Trost, S.G.: Measuring and Influencing Physical Activity with Smartphone Technology: A Systematic Review. *Sports Med* 44 (5), 671-686 (2014)
5. Lin, J.J., Mamykina, L., Lindtner, S., Delajoux, G., Strub, H.B.: Fish'n'Steps: Encouraging Physical Activity with an Interactive Computer Game. In: Dourish, P., Friday, A. (eds.): UbiComp 2006. LNCS, vol. 4206, pp. 261–278. Springer, Heidelberg (2006)
6. Consolvo, S., Klasnja, P., McDonald, D.W., Avrahami, D., Froehlich, J., LeGrand, L., Libby, R., Mosher, K., Landay, J.A.: Flowers or a robot army? In: 10th international conference on Ubiquitous computing (UbiComp), pp. 54–63. ACM Press, New York (2008)
7. King, A.C., Hekler, E.B., Grieco, L.A., Winter, S.J., Sheats, J.L., Buman, M. P. et al.: Harnessing different motivational frames via mobile phones to promote daily physical activity and reduce sedentary behavior in aging adults. PloS one 8 (4), e62613 (2013)
8. Bonezzi, A., Brendl, C.M., de Angelis, M.: Stuck in the middle: the psychophysics of goal pursuit. Psychological science 22 (5), 607–612 (2011)
9. Koo, M., Fishbach, A.: The Small-Area Hypothesis: Effects of Progress Monitoring on Goal Adherence. Journal of Consumer Research 39 (3), 493–509 (2012)
10. Fishbach, A., Koo, M., Finkelstein, S.R.: Motivation Resulting from Completed and Missing Actions. In: Olson, J.M., Zanna M.P. (eds.) Advances in Experimental Social Psychology, vol. 50, pp. 257–307. Elsevier (2014)

## Participatory development of Virtual Reality to coach forensic psychiatric patients

Hanneke Kip[1], Saskia M. Kelders[1], Yvonne Bouman[2], Dirk Dijkslag[2], & Lisette van Gemert-Pijnen[1]

[1]University of Twente, The Netherlands
[2]Transfore, The Netherlands
✉ h.kip@utwente.nl

The role of eHealth in Dutch mental healthcare is increasing and has shown a lot of potential with respect to improving effectiveness, quality of care, and self-management. However, the use of eHealth in Dutch forensic psychiatry is lagging a bit behind [1]. The main difference with regular mental healthcare is that forensic psychiatry's main goal is to prevent recidivism instead of improving or curing psychological disorders. Therefore, it is a specific domain of mental healthcare: most patients are low in treatment motivation, have low literacy and suffer from multiple, complex psychiatric disorders [2, 3]. Also, its main goal is preventing recidivism instead of improving or curing psychological disorders. It is deemed essential that an eHealth technology addresses these specific characteristics of the patients and the forensic context [1].

Virtual Reality (VR) is a technology that has a lot of potential for forensic psychiatry [4] because of the following reasons. First, studies on the use of VR in general mental healthcare have shown that it is effective for a broad range of disorders, also present in forensic psychiatric patients [5]. Also, VR technologies can be tailored by adapting it to the characteristics of a patient and by increasing the degree of difficulty of the scenario [6], making it suitable for the large differences within this target group. Finally, VR provides a realistic environment in which psychological skills can be observed and coached without requiring a high amount of literacy [7], which suits most forensic psychiatric patients.

However, at this point in time, little research on the use of VR in forensic psychiatry has been done [4]. This means that it is not possible to implement an existing, evidence-based VR technology specifically focused on forensic psychiatry. Consequently, VR technologies that seamlessly fit the forensic patient and his or her context have to be developed. A method that supports eHealth developers in achieving this is participatory development [8]. Participatory development can be defined as the involvement of users and other stakeholders during each phase of the eHealth development process [9]. The CeHRes Roadmap provides a guideline for participatory development, implementation and evaluation of eHealth technologies such as VR, in order to ensure a good fit between technology, context and people [10]. The goal of this poster is to describe a multimethod participatory development process of a persuasive VR technology in forensic psychiatry by means of the CeHRes Roadmap.

This VR project mainly involves on the first three phases since the focus lies on a proper development process. Implementation across the organization and summative evaluation are beyond the scope of the project. The relevant phases and their accompanying methods are described below.

### Contextual inquiry

The main goals of the contextual inquiry are to provide an overview of the current situation, its issues, and relevant stakeholders. The following methods were used in the VR project: a literature review on the use of VR in forensic psychiatry; desk research to find out about stakeholders, current treatments and protocols within forensic psychiatry, and rules and guidelines on the use of VR; and interviews and focus groups with therapists and patients to find out about issues and points of improvement of the current treatments. Preliminary results of this will be presented.

**Value specification**

The main goals of the value specification phase are to find out about the needs and wishes of relevant stakeholders concerning the technology, and the specific requirements of this technology. In the current project, focus groups with both forensic psychiatric patients and therapists to gather their ideas about possible applications of VR have been held. Furthermore, semi-structured interviews with patients and therapists will be conducted to discuss concrete VR scenarios that are based on the aforementioned focus groups. Finally, a focus group with both patients, therapists and researchers will be held to define requirements for the VR application, based on the results of the previous methods.

**Design**

In the design phase, requirements are used to develop several prototypes that are evaluated with stakeholders and lead to the technology that will be implemented in practice. Also, persuasive elements and behaviour change theories are added to the technology. In the current VR project, multiple theory based lo-fi prototypes with persuasive elements will be developed together with patients, therapists, researchers, VR developers and other stakeholders. Several usability tests of these prototypes will be conducted with stakeholders to find out about their opinions and possible points of improvements of the design. The final VR technology will be pilot tested in several treatments.

**References**

1. Bierbooms J, Bouman Y, Dijkslag D, Kimpen R, Muller J, Wieske, R. (2015) Do's en don'ts van e-health in de forensische ggz. Deventer: Transfore.
2. Nieuwenhuizen C, Bogaerts S, De Ruijter EAW, Bongers IL, Coppens M, Meijers RAAC (2011) TBS-behandeling geprofileerd. GGzE.
3. Drieschner KH, Boomsma, A. (2008) The treatment motivation scale for forensic outpatient treatment (TMS-F). Assessment, 15(2) 224-241.
4. Fromberger P, Jordan K, Müller, J L (2014) Anwendung virtueller Realitäten in der forensischen Psychiatrie. Der Nervenarzt, 85(3), 298-303.
5. Turner, WA, Casey LM (2014) Outcomes associated with virtual reality in psychological interventions: where are we now? Clinical Psychology Review, 34(8), 634-644.
6. Clough BA, Casey LM (2011) Technological adjuncts to increase adherence to therapy: a review. Clinical psychology review, 31(5), 697-710.
7. Tichon JG, Mavin T (2016) Using the Experience of Evoked Emotion in Virtual Reality to Manage Workplace Stress: Affective Control Theory (ACT). In: D Villani, P Cipresso, A Gaggioli, G Riva (Eds.) Integrating Technology in Positive Psychology Practice (pp. 344-362). Hershey, PA: IGI Global.
8. Beerlage-de Jong N, Wentzel J, Hendrix R, van Gemert-Pijnen, JEWC (2017) The value of participatory development to support antimicrobial stewardship with a clinical decision support system. American Journal of Infection Control.
9. Gemert-Pijnen JEWC van, Peters O, Ossebaard HC (2013) Improving eHealth. Eleven International Pub.
10. Gemert-Pijnen, JECW. van, Nijland N, van Limburg M, Ossebaard HC, Kelders SM, Eysenbach G, Seydel, ER (2011) A holistic framework to improve the uptake and impact of eHealth technologies. Journal of medical Internet research, 13(4), e111

# Wearables at Work for Health Promotion: Preferences from an Employee's Perspective

Aniek Lentferink[1-2-3], Hilbrand Oldenhuis[1], Martijn de Groot[2], Louis Polstra[1], Hugo Velthuijsen[1], & Lisette van Gemert-Pijnen[3]

[1]Marian van Os Centre of Entrepreneurship, Hanze University of Applied Sciences, Groningen, The Netherlands
[2]Quantified Self Institute, Hanze University of Applied Sciences, Groningen, The Netherlands
[3]Psychology, Health & Technology, University of Twente, Enschede, The Netherlands
✉ {a.j.lentferink, h.k.e.oldenhuis, m.a.degroot, l.polstra, h.velthuijsen}@pl.hanze.nl, j.vangemert-pijnen@utwente.nl

## Introduction

Improving health behaviour is an effective strategy to decrease absenteeism at work [1]. Self-tracking via wearables enables new possibilities for workplace health promotion [2]. For example, personal health data collected by wearables can serve as input for an automated virtual coach to provide personally relevant feedback 24/7. To make the best out of wearable technology at work, it is important to comply with the wishes and needs of its users. This study aims to identify the wishes and needs of employees for the use of wearables at work to improve health behaviour.

## Methods

Employees from the University of Twente (UT) were invited to wear a wearable (Pebble Smartwatch, Misfit Shine, or Apple Watch) during lunch walks around the campus organized during the UT Health Week of May 2016. After the walk, employees were asked to fill in a survey on wishes and needs concerning the use of wearable technology for workplace health promotion (see Appendix 1 for the survey). 76 employees with a mean age of 40 years old (SD ±11.7) filled in a survey. Most participants were female (69%) and used one of the wearables during the lunch walk (88%). Analyses were of a descriptive nature.

## Results

***Wearables in general*** Most employees believed that a wearable could have a reasonable to a considerable contribution to improving health behaviour (score 3 or 4 on a scale from 1-5). The preferred wearables for monitoring health behaviour were wearable sensors in a smartphone (40.3%, more than one answer was possible), followed by wearable sensors outside a smartphone for continuous measurements (37.3%). 59% of the participants were willing to use a wearable for a longer period with a mean duration of 5.5 weeks (SD ±7.5). One of the major barriers for wearable use was the continuous wearing of a device, according to 50.7% of the employees (more answers were possible). In addition, employees did not want to keep track of additional health-related data that is not automatically being captured by the device (53.4%). Forty-six participants described positive aspects of wearables. The most mentioned positive aspects were: (1) insights into own personal health behaviour (n=27); (2) pleasant design of the Misfit Shine (n=7). Forty-two participants described negative aspects of wearables. The most mentioned negative aspects were: (1) poor visualization of the data without the smartphone application (n=12); (2) unpleasant to wear (n=10); (3) need for observing more than just steps (n=5). The first aspect was about the Misfit Shine that showed progress towards the goal (10,000 steps per day) by means of lights on the bracelet.

***Wearables at work*** Sixty-four participants described positive aspects of wearable technology at work to improve health behaviour. The most mentioned aspects were: (1) improve the health of employees (n=26); (2) awareness about health behaviour at work (n=23); (3) increase fellowship by supporting each other (n=5); (4) engagement of employer (n=4). Fifty participants described negative aspects of wearable technology at work to improve health behaviour. The most mentioned negative aspects were: (1) privacy issues due to collection of personal data (n=13); (2) feeling checked up on (by employer) (n=6); (3) an extra task for the employee (n=6); (4) obligation to use (n=6). Participants had rather similar ideas about data sharing with others. According to employees, physicians or other health carers

(n=12) and researchers (n=12) were allowed to have access. A lot of employees (n=17) felt the data should not be shared with anyone or solely when access is provided by the user her-/himself (n = 5). Mostly, the participants mentioned no access for employers or supervisors (n=15).

## Discussion

This study provides a first impression of the wishes and needs on the use of wearable technology for workplace health promotion from an employee's perspective. Most employees see the potential of using wearable devices for workplace health promotion. However, according to employees, some negative aspects should be overcome before wearables can effectively contribute to health promotion. The most mentioned negative aspects were poor visualization and unpleasantness of wearing. Specifically for the workplace, employees were concerned about the privacy of data collection.

Similar to results from a scoping review [3], it was found that users perceived it valuable to capture all relevant personal health data, to obtain insights in health behaviour, and receive clear visualization of self-tracking data. In contrast to results from the scoping review, respondents in this study found it burdensome to collect additional data. However, the scoping review suggested that requiring more effort from the participant for self-tracking did not negatively affect usability as long as it is in balance with its added value [3].

Results from a meta-analysis showed that the use of wearable devices for health promotion contributes to health behaviour change [4]. However, Patel and colleagues [5] state that more is needed. Some needs and wishes identified in this study confirm what Patel et al argue to be potential solutions to bridge the gap between increases in behavioural motivation due to wearable devices and actual behaviour change. Firstly, the use of a smartphone that contains sensor technology could diminish the burden of wearing the device constantly as people are already used to wearing a smartphone on them most of the time. Secondly, the most mentioned negative aspect was feedback that was not understood. Improving the feedback loop and making it understandable is another aspect suggested by Patel and colleague. Finally, some respondents in this study mentioned that the use of wearables at work could increase fellowship among colleagues. This might be extended by means of leveraging team-based designs and social norms feedback. Employees do not want to disappoint other colleagues for missing out rewards based on group accomplishments [5].

Needs and wishes identified from this study will be used during the development of eHealth technologies using wearables in a workplace setting. However, results of this study are not conclusive as the survey-method could not identify underlying reasons and academic personnel might differ from other groups of employees.

## References

1. Baicker K, Cutler D, Song Z. Workplace wellness programs can generate savings. Health affairs. 2010;29(2):304-311. doi:10.1377/hlthaff.2009.0626
2. Dallery J, Kurti A, Erb P. A new frontier: Integrating behavioral and digital technology to promote health behavior. The Behavior Analyst. 2015;38(1):19-49. doi:10.1007/s40614-014-0017-y
3. Lentferink A, Oldenhuis H, De Groot M, Polstra L, Velthuijsen H, Van Gemert-Pijnen L. Key Components in eHealth Interventions Combining Self-Tracking and Persuasive eCoaching to Promote a Healthier Lifestyle: a Scoping Review. *Submitted to:* Journal of Medical Information Research.
4. De Vries HJ, Kooiman TJ, van Ittersum MW, van Brussel M, de Groot M. Do activity monitors increase physical activity in adults with overweight or obesity? A systematic review and meta-analysis. Obesity. 2016;24(10):2078-2091. doi:10.1002/oby.21619
5. Patel MS, Asch DA, Volpp KG. Wearable devices as facilitators, not drivers, of health behavior change. Jama. 2015;313(5):459-460. doi: 10.1001/jama.2014.14781

# The introduction of a new shopping experience: How persuasive technology affects consumer experience in stores

Lina Marteros, Mirjam Galetzka, Anna Fenko, & Wenda Kielstra

Communication Science, University of Twente, Enschede, The Netherlands
✉ m.galetzka@utwente.nl

In five to ten years' time, the retail environment for stores and consumers will change significantly. Both the retail industry and their customers can benefit from persuasive in store technologies because they can be used to model customer behaviour, deliver targeted products, services and promotion offerings to consumers, hence enhancing the shopping experience of consumers in terms of both value and affective reactions [1, 2].
The purpose of the present studies is to evaluate the effectiveness of a 3D body scanner in a luxury lingerie store to enhance the in-store shopping experience, by taking the relation to the personal innovativeness of consumers into account. However, the present studies do not solely focus on the effectiveness of persuasive in store technology. It also looks at the value of store employees and what their role is in the consumer experience, with or without the presence of technology. Furthermore, the studies combine two classical theoretical models, i.e., Stimulus-Organism-Response (S-O-R) model by Mehrabian and Russell [3] and the Technology Acceptance Model (TAM) by Davis [4]. The S-O-R model [3] evaluates how stimuli in the environment trigger emotions and subsequent behavior, in this case the approach-avoidance behavior of consumers when they walk into a store with advanced technologies. The stimulus (e.g., a persuasive technology) triggers users' cognitive and affective states, which impacts how they respond to it in their behavior [5].
TAM presumes that the perceived usefulness and perceived ease of use are important determinants of the acceptance of technologies [4]. In the context of retail environments, persuasive technologies have the ability to combine the best of offline experiences (interactions with staff and products) with online experiences (product reviews, rating, recommendations) which in turn enhance the consumer experience [6].
Even though the presence of persuasive in store technology is important in the overall perception, the presence of employees is also relevant in order to evaluate the effect that employees have in the shopping experience [7]. Moreover, a consumer's willingness to use persuasive in store technologies depends on the level of technology readiness and the perceptions of the employees [7,8]. When it comes to technology readiness, every persons approaches the technology differently. Several studies showed that consumers with a high level of innovativeness are more likely to use persuasive technologies in online and offline retail environments [9,10].
Two studies were conducted to examine the influence of both technology presence and employee presence. Study 1 is an exploratory research conducted with interviews among female users (n= 10) of a 3D body scanner at a luxury lingerie store in Amsterdam, the Netherlands, ranging from 17 to 64 years of age. Study 2 is an online experiment (n = 200) on the effect of a 3D body scanner and employee presence on consumer experience, in relation to the personal innovativeness of the consumer. This study utilizes a 2 (technology-based shopping vs. traditional shopping) x 2 (employee presence vs. employee absence) between-subjects factorial design. Four videos were developed in order to manipulate the shopping experience and employee value. The videos reflect different shopping experiences in the same store (with or without the help of an employee, while making use of the same technology, or a more traditional shopping experience with or without the presence of an employee). After seeing one of the video's, the respondents were asked to answer some questions on their utilitarian and hedonic shopping experience, the store image, perceived usefulness of the 3D body scanner, perceived ease of use and their personal innovativeness.

Results show that the 3D body scanner does influence the shopping experience of consumers positively. However, it does not influence this experience on its own, as the presence of an employee also plays a great role in making this experience more pleasurable. Contrary to initial expectations, the influence of emotional shopping values had no significant impact on the in-store shopping experience. A surprising finding of this study is an interaction effect that indicates that technology presence has a statistically significant effect on store image in the absence of an employee; which is especially the case for people with a high level of personal innovativeness. Therefore, one may assume that in the presence of an in-store technology, the value of an employee decreases. However, participants found it important to have a clear explanation from the store about the technology, about the use, what it does and to reassure them that it is completely safe. If the store makes sure that one can trust the technology and convince customers that their privacy is completely safe, then one would have a more positive attitude toward the 3D body scanner, thus has a higher intention to use and recommend the technology.

The findings of this study provide important implications for both retailers and academics in the field of persuasive technology, especially for those considering persuasive in store technologies. One should be aware that both persuasive technologies and the presence of employees are part of the consumer experience. It is recommended that employees have an assisted role and give additional advice based on their experience. Employees should be involved, as this study found that a customer feels more comfortable and worries less about any risks while using the technology.

## References

1. Poncin, I., & Mimoun, M. S. B.: The impact of “e-atmospherics” on physical stores. Journal of Retailing and Consumer Services, 21(5), 851-859 (2014)
2. Kaptein, M.C. Formalizing Customization in Persuasive Technologies. In T. MacTavish and S. Basapur (Eds.): PERSUASIVE 2015, LNCS 9072, pp. 27–38. Springer International Publishing Switzerland (2015) DOI: 10.1007/978-3-319-20306-5_3
3. Mehrabian, A., & Russell, J. A.: An approach to environmental psychology. The MIT Press (1974)
4. Davis, F. D.: Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS quarterly, 319-340 (1989)
5. Dupré, D., Dubois, M., Tcherkassof, A., & Pizelle, P.: Measuring emotional states and behavioral responses to innovative design. International Design and Emotion Conference London. Retrieved December 29, 2014, from http://www.academia.edu/1798457/Measuring_Emotional_States_and_Behavioral_Responses_to_Innovative_Product (2012)
6. Longo, S., Kovacs, E., Franke, J., & Martin, M.: Enriching shopping experiences with pervasive displays and smart things. In Proceedings of the 2013 ACM conference on Pervasive and Ubiquitous Computing Adjunct Publication (pp. 991-998). ACM (2013, September)
7. Baker, J., Parasuraman, A., Grewal, D., & Voss, G. B.: The influence of multiple store environment cues on perceived merchandise value and patronage intentions. Journal of Marketing, 66(2), 120-141 (2006)
8. Berry, L. L., Bolton, R. N., Bridges, C. H., Meyer, J., Parasuraman, A., & Seiders, K.: Opportunities for innovation in the delivery of interactive retail services. Journal of Interactive Marketing, 24(2), 155-167 (2010)
9. Pantano, E., & Di Pietro, L.: Understanding Consumer’s Acceptance of Technology-Based Innovations in Retailing. Journal of Technology Management & Innovation, 7(4), 1-19 (2012)
10. Huang, T. L., & Liao, S.: A model of acceptance of augmented-reality interactive technology: the moderating role of cognitive innovativeness. Electronic Commerce Research, 15(2), 269-295 (2014)

## A prototype persuasive design tool for learning and development professionals

Ciarán O'Leary, Claire McAvinia, & Fred Mtenzi

Dublin Institute of Technology, Ireland
✉ ciaran.oleary@dit.ie

Learning and development professionals [1] aim to develop positive behaviours and habits among an organisation's workforce. These behaviours may relate to shar-ing knowledge [8]; personal reflective practice [14]; or stress management [11], as example. Persuasive technology [3] is concerned with the formation of behaviour and habits with the support of technology. Fogg argues in favour of the use of "*technology channels that are familiar to the target user*" when designing persuasive technology solutions, since both the adoption of a new technology and the implementation of a behaviour change can be too significant a change [4]. By adopting a practice-based [7,10,16] rather than an artifactual view of technology, familiar technology channels are distinguished from each other based on the performance of technologies in practice (including performances unintended by the designer [6]). Learning and development professionals are not (usually) designers equipped with technical skills but they can be enabled to design technology-based solutions by tying simple behaviour triggering events to the performance of familiar technology channels, akin to Wakkary's [17] description of how informal designers use everyday objects as creative resources. To carry out this type of design, learning and development professionals need to be provided with an accessible, reflective, and operable representation of the diverse technology channels familiar to the audience [9]. *onBoard* is a prototype tool which does so by providing three entangled views of an organisation. First, it provides a **practice** view which describes the practices enacted in the organisation. The practices are investigated using situated ethnographic methods e.g. contextual inquiry [2], practical inquiry [5] or similar, and are documented in a narrative format which is accessible to non-professional designers. The practices do not specifically foreground the use of technology but rather are reflective of the multi-dimensional nature of social [12,13] (or sociomaterial [10]) practices. The **touchpoint** view presents the user with an array of technology channels performed in the practices of the audience. These touchpoints can be understood in the context of the practice view and can be made operable for design through the tool which enables their selection and incorporation into a design space. In using the tool, a learning and development professional can select a set of touchpoints upon which they intend to base their persuasive design strategy. However, they need to understand the degree to which that strategy is reflective of the breadth of their audience. This is addressed through the **people** view, formed through the clustering of technology channels. Use of the tool enables a learning and development professional to gain an understanding of the practices of their audiences, select a set of technology touchpoints from those practices, review the coverage of the set of touchpoints with respect to the breadth of their audience, and develop a multi-part persuasive technology-based strategy in a design space which presents them with the selected touchpoints. This poster presents a prototype imple-mentation of the *onBoard* tool developed as an interactive website for learning and development professionals in a specific university. Data for the prototype was collected and analysed using a specific sociomaterial theoretical lens [15].

### References

1. Beevers, K., & Rea, A. (2016). Learning & Development Practice in the Workplace. CIPD
2. Beyer, H., & Holtzblatt, K. (1993). Contextual Design: Defining Customer-Centered Sys-tems. San Francisco, Calif: Morgan Kaufmann Publishers Inc.
3. Fogg, B. J. (2002). Persuasive Technology: Using Computers to Change What We Think and Do. Boston: Morgan Kaufmann Publishers Inc.
4. Fogg, B. J. (2009). Creating persuasive technologies: an eight-step design process. Goldkuhl, G. (2008). Practical Inquiry as Action Research and Beyond. In ECIS (pp. 267).

5. Krischkowsky, A., Maurer, B., & Tscheligi, M. (2016). Captology and Technology Appropriation. In Proceedings of the 11th International Conference on Persuasive Technology
6. Kuutti, K., & Bannon, L. J. (2014). The turn to practice in HCI: towards a research agenda. In Proceedings of the 32nd annual ACM conference on Human factors in Computing
7. Nonaka, I. (2008). The knowledge-creating company. Harvard Business Review Press.
8. O'Leary, C., Mtenzi, F., & McAvinia, C. (2016). Understanding the Everyday Designer in Organisations. Tackling Society's Grand Challenges with Design Science, 114.
9. Orlikowski, W. J. (2007). Sociomaterial Practices: Exploring Technology at Work. Org. S.
10. Quick, J. C., Quick, J. D., Nelson, D. L., & Hurrell Jr, J. J. (1997). Preventive stress management in organizations. American Psychological Association.
11. Reckwitz, A. (2002). Toward a Theory of Social Practices A development in culturalist theorizing. European Journal of Social Theory, 5(2), 243–263.
12. Schatzki, T. R., Knorr-Cetina, K., & von Savigny, E. (2001). The practice turn in contemporary theory. Psychology Press.
13. Schön, D. A. (1987). Educating the reflective practitioner: Toward a new design for teaching and learning in the professions. Jossey-Bass.
14. Scott, S. V., & Orlikowski, W. J. (2014). Entanglements in practice: performing anonymity through social media. Sociomateriality.
15. Suchman, L. (2006). Human-Machine Reconfigurations: Plans and Situated Actions.
16. Wakkary, R., & Maestri, L. (2007). The resourcefulness of everyday design. In Proceedings of the 6th ACM SIGCHI conference on Creativity & cognition (pp. 163–172). ACM.

# Effects of Personality on Cialdini's Persuasive Strategies

Kiemute Oyibo[1], Rita Orji[2], & Julita Vassileva[1]

[1]University of Saskatchewan, Saskatoon, Canada
[2]University of Waterloo, Waterloo, Canada
✉ {kiemute.oyibo, jiv}@cs.usask.ca, rita.orji@uwaterloo.ca

## Introduction

There are ongoing efforts by researchers to find effective ways to personalize persuasive applications for maximum impact on behavioral change. Recently, research has shown that personality traits can predict the responsiveness of individuals to persuasive strategies [1], [4]. While there have been few studies on the influence of the Big Five on Cialdini's six principles of persuasion (e.g., [1] among the Turkish population), studies among individualist cultures are scarce. To bridge this gap, we conducted a study of 216 Canadians to uncover how the Big Five impacts Cialdini's persuasion principles and compare our findings with those of Alkış and Temizel [1]. The prior study by these authors has some limitations, such as the use of convenience sample. Our study addresses this limitation by recruiting subjects beyond the four walls of the university.

## Method

We designed an online survey using existing scales on the Big Five personality traits [2] and Cialdini's persuasion principles [3] and recruited subjects on the University of Saskatchewan website and Amazon Mechanical Turk. The former were given a chance to win a $50 CAD gift card, while the latter were paid $0.8 per participant. A total of 216 Canadians participated in the study: 31.5% (males), 65.3% (females) and 3.2% (unknown). Further, 32.9% were between 18-24 years old and 67.1% above 24. Lastly, 25.0%, 50.9% and 24.1% had high-school, university and other education respectively.

## Results

We built a model of each persuasive strategy, with the personality traits as predictors [1], [4]. We assessed the inner models and took the recommended steps to ensure the reliability and validity of the constructs. We present our results as follows:

1. **Authority:** It is negatively influenced by *Openness* ($\beta = -0.14$, $p < 0.05$), but positively influenced by *Agreeableness* ($\beta = 0.25$, $p < 0.01$).
2. **Commitment:** It is positively influenced by *Conscientiousness* ($\beta = 0.17$, $p < 0.05$) and *Agreeableness* ($\beta = 0.18$, $p < 0.05$).
3. **Consensus:** It is negatively influenced by *Openness* ($\beta = -0.18$, $p < 0.01$), but positively influenced by *Neuroticism* ($\beta = 0.27$, $p < 0.001$).
4. **Liking:** It is negatively influenced by *Openness* ($\beta = -0.17$, $p < 0.05$) and *Conscientiousness* ($\beta = -0.36$, $p < 0.001$), but positively influenced by *Agreeableness* ($\beta = 0.19$, $p < 0.05$).
5. **Reciprocity:** It is positively influenced by *Conscientiousness* ($\beta = 0.25$, $p < 0.001$).
6. **Scarcity:** None of the personality traits has significant influence on Scarcity.

## Discussion and Conclusion

Overall, our model shows that *Agreeableness* and *Conscientiousness* are the strongest predictors of Cialdini's principles, as found by [1]. *Agreeableness* positively influences Authority ($\beta = 0.25$, $p < 0.01$), Commitment ($\beta = 0.18$, $p < 0.05$) and Liking ($\beta = 0.19$, $p < 0.05$), while *Conscientiousness* positively influences Commitment ($\beta = 0.17$, $p < 0.05$) and Reciprocity ($\beta = 0.25$, $p < 0.001$), but negatively influences Liking ($\beta = -0.36$, $p < 0.001$). While the Big Five predicts Authority, Commitment, Consensus, Liking and Reciprocity, it does not predict Scarcity, indicating it may be one of the hardest persuasive strategies to predict. Similarly, while *Agreeableness*, *Conscientiousness*, *Openness* and *Neuroticism* predict the persuasive strategies, *Extraversion* does not. In sum, our findings replicate half of the findings by [1] and reveal that individuals who are 1) high in *Conscientiousness* are more responsive to

Commitment and Reciprocity, but less responsive to Liking; 2) high in *Agreeableness* are more responsive to Authority, Commitment and Liking; 3) low in *Openness* are more responsive to Authority, Consensus and Liking; and 4) high in *Neuroticism* are more responsive to Consensus.

## References

1. Alkış, N., Temizel, T.T.: The impact of individual differences on influence strategies. Pers. Individ. Dif. 87, 147–152 (2015).
2. Gosling, S.D. et al.: A very brief measure of the Big-Five personality domains. J. Res. Pers. 37, 6, 504–528 (2003).
3. Kaptein, M. et al.: Adaptive Persuasive Systems: A Study of Tailored Persuasive Text Messages to Reduce Snacking. ACM Trans. Interact. Intell. Syst. 2, 2, 1–25 (2012).
4. Orji, R. et al.: Towards Personality-driven Persuasive Health Games and Gamified Systems. Proc. SIGCHI Conf. Hum. Factors Comput. Syst. (2017).

# How Humans Interact With Emojis In SMS Environments: Preliminary Results From 3 Pilot Studies

Ariana Qayumi, Phoebe Fu, & BJ Fogg

Stanford Persuasive Technology Lab, USA
✉ aaqayumi@stanford.edu, yfu2@stanford.edu

## Introduction

Emojis have evolved as an interesting symbolic system in our daily communication yet it remains a fairly nebulous and unexplored field when it comes to academic research. In our three-pronged pilot study series, we aim to unpack how emojis are used in SMS messaging environments and explore the possibility that there might be a connection between a person's emoji usage and a person's personality. In turn, we also hope to provide a systematic experiment design about how to collect meaningful data from emoji communications, as these are at the root, communications initiated and facilitated by human interaction.

## Pilot Study 1: Conversion

Pilot Study 1 collects preliminary data to understand whether using emoji symbols can motivate people to complete a simple task. 40 college-aged volunteers were recruited and asked to fill out an online survey via SMS texts. The study consists of two phases. The first phase was implemented on a Thursday afternoon with 20 participants and the second phase on a Monday evening with the rest 20 participants. In each of the two phases, participants were randomly assigned to either the control condition or the emoji condition. The survey request SMS message for the control condition was purely text-based whereas the one in emoji condition contained the same wording plus 6 emoticons (3 grinning faces and 3 smiling faces with halo). The dependent variables are response time and conversion rate. Preliminary results show that people in the emoji condition had quicker response time and equal or higher conversion rate.

## Pilot Study 2: Engagement

Pilot Study 2 aims to unpack whether using certain types of emoji symbols can facilitate sustained performance in the same task. 30 college-aged volunteers were asked to do an exhaustion task via SMS texts in which they send the experimenter as many brand names as they could come up with. Participants were randomly assigned to one of the following conditions: control, smiley face emojis or hand gesture emojis. Participants were instructed to send one brand name at a time and wait for the experimenter's response. In the control condition, the experimenter always responded with the text "OK". In contrast, the experimenter responded with "OK" plus various occurrences of smiley face emojis or hand gesture emojis, in the smiley face condition and hand gesture condition, respectively. Sustained engagement was measured by time elapsed between first and last item as well as number of items sent to the experimenter. Preliminary analysis reveals that participants in the smiley face emoji condition showed worse engagement compared to their counterparts in the other two conditions (one-way ANOVA on time elapsed is marginally significant $F = 2.12$, $p = .14$).

## Pilot Study 3: Context and Meaning

Pilot study 3 aims to unveil whether the context and meaning of frequently used emojis via SMS texting can have different meanings to people of a similar group, and if so, which context-meaning combinations are deemed most appropriate. This was completed in three sub-goals: (1) Collect Screenshots, (2) Collect Context and Meaning of Frequently Used Emojis, and (3) Collect Feedback About Appropriateness of Others' usage. 20 participants were prescreened and 5 participants were run. Preliminary analysis reveals that there might be a fundamental mistake in behavior change invisible to the human eye. We are ignoring how environment shapes behaviors. The fact of the matter is that changing context, changes

meaning of objects used in that context versus another. I.e., When emoji context is changed, the emoji meaning is also changed; when emoji context is changed, emoji appropriateness for that context is also changed. Next steps will include exploring the appropriateness of emoji usage per context and based on personality. Our hypothesis is that there is a digital identity underlying participants' use of emojis in SMS text message conversations.

## Conclusion

The three pilot studies above show interesting patterns in people's interaction with emoji symbols in SMS messaging environments. While certain emojis can be leveraged to enhance conversion rate in some contexts, other emojis may have a negative impact on sustained engagement. Given this preliminary behavioral evidence, we move forward with the aim to unpack fundamental psychological principles that guide those patterns observed. One direction that we are currently conceptualizing is person 1's perception of person 2's personality given person 2's emoji usage. Eventually, we hope to apply basic psychological principles found in the course of research, in the context of behavior change; specifically, we aim to provide a framework about how to design for effective persuasive emoji use in digital media.

## References

1. Miller, Hannah, et al. "“Blissfully happy” or “ready to fight”: Varying Interpretations of Emoji." ICWSM'16 (2016).
2. Akman, Varol, and Mehmet Surav. "The use of situation theory in context modeling." Computational Intelligence: An International Journal 13.3 (1997): 427-438.

# Applying Persuasive Criteria to assess two Automotive Mobile Applications: A Methodological Approach

Perrine Ruer[1], Sandrine Prom-Tep[2], & Saad Abdessettar[3]

[1]LICEF Research Center, Télé-Université du Québec, Montréal, Canada
[2]Marketing Department, ESG Business School - Université du Québec à Montréal, Montréal, Canada
[3]Automated Manufacturing Engineering Department, École de Technologie Supérieure, Montréal, Canada
✉ pruer@teluq.ca

## Introduction

Various methods exist to develop and assess the persuasiveness of technologies. However, few studies focus on interface assessment on technology. In ergonomics, user interface assessment is a well-known method used to improve usability. Nemery and Brangier [1] developed persuasive criteria to assess the persuasion of user interface. This methodological approach is quite unusual compared to conventional persuasive methods. Conventional methods do not take into consideration the temporal dimension required for an interactive dynamic persuasion. The importance of guidelines remains to be shown in order to evaluate persuasion in Human-Computer Interaction (HCI). The assessment of persuasive interface is considered time-consuming and often less useful. The benefits allow to measure and establish the problems at the interface level, which helps to assess the usability and the persuasiveness of applications (app.).

The aim of our research is to determine whether the methodological approach proposed by Nemery & Brangier can apply to automotive mobile app. and assess the persuasive dimensions of the interface. To reach our objective, we applied criteria [1] to evaluate the quality of two automotive mobile app. in their ability to persuade. This exploratory work seeks to help design experts better assess the persuasive aspects of automotive mobile app. And, in this regard, it will help them design mobile app. which can engage the driver to modify his/her behaviour and to drive more safely.

## Related works

In the scientific literature, we found different methods for designing persuasive technologies. Some methods focus on the interface design, but few of them have been developed to assess the effectiveness of the interface itself. In the persuasive scientific literature, we can differentiate persuasive design implementation criteria [2-5] and criteria to assess how persuasive the technology's app. is [1, 6]. We chose the persuasive criteria proposed by Nemery and Brangier [1] since they focus specifically on interactive persuasive aspect of the interface. Their work focused on interactive persuasion in software and website interface, but not in mobile app. Furthermore, they assessed app. in different areas (e-commerce, corporate and, social media), but not the automotive industry. Duczman et al. [7] highlighted the need to consider further interface aspects by conducting inspection of driving mobile app., as they can be supported by both individual and social contexts.

About persuasion concepts applied to automotive app., Schätzl [8] described persuasive technologies can be fitted for road safety to improve the user's behaviour and motivate the driver. Two basic approaches exist. The first one is to provide the current individual with real-time feedback on his/her driving behaviour; with recommendations, for instance. The second basic approach is to accumulate information about the driving and driver behaviour and provide accumulated feedback to the driver.

## Methodology

Regarding our methodological approach, we conducted an inspection using persuasive criteria to analyze the persuasive dimensions and their effects. Indeed, criteria allow the detection of persuasive interactive elements in existing interface. Nemery and Brangier [1] proposed eight

persuasive criteria and 23 sub-criteria, based on an analysis of the persuasive scientific literature. Criteria involve both static and dynamic aspects to assess the user interface. Static criteria are necessary to promote the acceptance and influence of technology. Static criteria are Credibility, Privacy, Personalization, Attractiveness. And dynamic criteria encourage users to change their behaviour in an organized manner. Dynamic criteria refer to Solicitation, Initiation, Commitment and Ascendency. The particularity of the dynamic criteria is their temporal aspect. Our case study consisted of analyzing and evaluating two types of mobile automotive app., both involving high interactivity and dependency on contextual information. The difference between them lies in the fact that one app. includes a social motivational aspect: Waze, and the other targets individual motivation: Ajusto. Waze is a mobile navigation app. based on the sharing of traffic and road information between members in each city in real time. And Ajusto is a mobile insurance app. in French Canada based on the user's driving habits and to give feedback to the driver to drive safely. We chose these two driving mobile app. based on their Internet reputation, and because they were free to be downloaded.

## Results

With the aid of the static and dynamic criteria, we assessed the Waze and Ajusto interfaces. We identified the main persuasive strength and weakness aspects. As we have observed with the assessment analysis, Waze implies many social intents exchanged between users through the media in a transparent way. The major weakness is regarding privacy. The assessment of Ajusto's persuasive interface was easier to conduct since the app. relies more on personal driving behaviour facts than on social interaction such as Waze. Applying these criteria in this case study allowed us to assess performance of the grid in evaluating persuasiveness when applied to automotive mobile app.

## Conclusion

This exploratory work contributes to the inspection methods used to assess persuasive technology's interfaces in the field of automotive mobile app. The evaluation showed that the persuasive criteria developed by Nemery and Brangier can be applied to assess mobile automotive interface. Criteria were applied on two automotive app. These instances show how applying static and dynamic criteria enabled the persuasiveness of both mobile app. to be highlighted. Results showed no unidimensional intent aspect are associated with driving safely, and persuasion may vary depending on the user's intent according to the functions available in the app. In order to confirm the use of persuasive criteria to evaluate automotive user interfaces, future research should validate this methodological approach with a sample of experts and an inter-reliability study.

## References

1. Némery, A. and E. Brangier, *Set of guidelines for persuasive interfaces: organization and validation of the criteria.* Journal of Usability Studies, 2014. **9**(3): p. 105-128.
2. Oinas-Kukkonen, H. and M. Harjumaa, *Persuasive Systems Design: Key Issues, Process Model, and System Features.* Communications of the Association for Information Systems, 2009. **24**: p. 485-500.
3. Fogg, B.J. *Creating persuasive technologies: an eight-step design process*. in *Persuasive*. 2009.
4. Fogg, B. *The behavior grid: 35 ways behavior can change*. in *Proceedings of the 4th international Conference on Persuasive Technology*. 2009. ACM.
5. Fogg, B. and J. Hreha, *Behavior wizard: a method for matching target behaviors with solutions*, in *Persuasive technology*. 2010, Springer. p. 117-131.
6. Lockton, D., D. Harrison, and N.A. Stanton, *The Design with Intent Method: A design tool for influencing user behaviour.* Applied ergonomics, 2010. **41**(3): p. 382-392.
7. Duczman, M., E. Brangier, and A. Thévenin, *Criteria Based Approach to Assess the User Experience of Driving Information Proactive System: Integration of Guidelines, Heuristic Mapping and Case Study*, in *Advances in Ergonomics in Design*. 2016, Springer. p. 79-90.
8. Schätzl, J., *How Effective are Persuasive Technologies in Automotive Context.* Persuasive Technologies and Applications, 2015.

# Smartphone-based experience sampling in young adolescents: advantages, concerns and challenges

Vivianne Thewissen & Nicole Gunther

Faculty of Psychology and Educational Sciences, Open University, Heerlen, The Netherlands
✉ viviane.thewissen@ou.nl

The increased use and ubiquity of smartphones among adolescents has encouraged the development of apps for real-time momentary assessment and intervention. Momentary assessment approaches, such as the Experience Sampling Method (ESM) [1] or Ecological Momentary Assessment (EMA) [2] are suitable to assess moods, thoughts, symptoms, behaviours and experiences, and their context, in the course of daily life. ESM is an internationally used and validated research method and has been successfully applied in both clinical and non-clinical populations [e.g. 3-5].

We are planning to conduct several studies in Dutch young adolescents using an Experience Sampling smartphone app. The app is programmed to give a series of signals at random moments throughout the day over the course of several days. Immediately after each signal, participants have to fill out a questionnaire on their smartphone (see accompanying poster by Gunther & Thewissen for detailed information regarding content of the studies). As previous research has highlighted the shortage of theoretical content present in mHealth technologies, assessment studies are a first necessary step in developing ESM smartphone intervention apps which provide individually tailored real-time feedback and advice.

ESM has several advantages as opposed to traditional assessment measures (i.e. retrospective questionnaires). First, ESM allows to study individuals in their own real-life environment rather than artificial environments like laboratory settings. Second, ESM yields momentary self-reported experiences. Retrospective self-reported experiences, on the other hand, may be affected by a memory bias. Third, ESM data collection results in multiple assessments over time, which allows for investigating time series and dynamic processes. Finally, ESM allows the evaluation of context in which moods, thoughts, symptoms, behaviours and experiences appear. Thus, ESM data can provide a detailed account and understanding of the dynamics of mental health states in youngsters' daily life.

Despite the advantages of this research method, there are some concerns and challenges regarding smartphone-based experience sampling assessment studies, especially when conducted in adolescents. First, there are some ethical issues to consider when conducting ambulatory assessment research using smartphones [6]. For example, as very personal data can be collected with smartphones, it is important to be careful to protect participants' privacy and confidentiality. A second issue concerns recruitment and compliance. The application of experience sampling for several consecutive days may place a considerable demand on the adolescents (and participating schools) which complicates recruitment. ESM smartphone-based studies in adolescents have demonstrated moderate compliance as opposed to traditional ESM studies in adolescents [7-8]. A third issue concerns decisions regarding the time-based design of the sampling protocol. The sampling rate (number of assessments) must be high enough to fit the temporal dynamics of the target processes (i.e. changes in moods, thoughts, symptoms, behaviours and experiences). However, the intervals between assessments may not be too short, thereby increasing participants' burden and endangering their compliance [9]. Another issue concerns the smartphone app itself. It is important to offer a user-friendly interface, especially in a target group of adolescents it is of importance that the app is appealing and simple in its use. All of the above mentioned challenges become even

greater when using an ESM smartphone intervention app which provides individually tailored real-time feedback and advice.

In conclusion, despite numerous advantages of smartphone-based experience sampling, there are also a number of concerns and challenges that need to be considered, especially when conducting studies in young adolescents.

## References

1. Hektner JM, Schmidt JA, Csikszentmihalyi M (2007) Experience Sampling Method: measuring the quality of everyday life. Thousand Oaks: Sage Publications.
   Shiffman S, Stone AA, Hufford MR (2008) Ecological momentary assessment. Annu Rev Clin Psychol 4:1-32. doi:10.1146/annurev.clinpsy.3.022806.091415
2. Myin-Germeys I, Oorschot M, Collip D, Lataster J, Delespaul P, van Os J (2009) Experience sampling research in psychopathology: Opening the black box of daily life. Psychol Med 39:1533–1547. doi:10.1017/S0033291708004947
3. Thewissen V, Bentall RP, Oorschot M, à Campo J, van Lierop T, van Os J, Myin-Germeys I (2011) Emotions, self-esteem, and paranoid episodes: An experience sampling study. Brit J Clin Psychol 50(2):178–195. doi:10.1348/014466510X508677
4. Wouters S, Thewissen V, Duif M, Lechner L, Jacobs N (2016) Assessing Energy Intake in Daily Life: Signal-Contingent Smartphone Application Versus Event-Contingent Paper and Pencil Estimated Diet Diary. Psychol Belg 56(4):357–369. doi:10.5334/pb.339
5. Trull TJ (2015). Ethical issues in researching daily life. Mon Psychol 46(4):70.
   Magallón-Neri E, Kirchner-Nebot T, Forns-Santacana M, Calderón C, Planellas I (2016) Ecological Momentary Assessment with smartphones for measuring mental health problems in adolescents. World J Psychiatr 6(3):303. doi:10.5498/wjp.v6.i3.303
6. Van Roekel E, Scholte RH, Engels RC, Goossens L, Verhagen M (2015) Loneliness in the daily lives of adolescents: An experience sampling study examining the effects of social contexts. J Early Adolesc 35(7):905-930. doi:10.1177/0272431614547049
7. Santangelo PS, Ebner-Priemer UW, Trull TJ (2013) Experience Sampling Methods in clinical psychology. In J.S. Comer, & P.C. Kendall, The Oxford handbook of research strategies for clinical psychology. Oxford: University Press.

# Innovative strategies to reduce incidence of hepatitis C virus infection among HIV-positive men who have sex with men in Amsterdam, The Netherlands – the MC Free project

Freke Zuure [1,2], Janke Schinkel [3], Udi Davidovich [1,2], Paul Zantkuyl [4], Wim Zuilhof [4], Maria Prins [1,2], & Marc van der Valk [2,5]

[1]Department of Infectious Diseases Research and Prevention, Public Health Service of Amsterdam, Amsterdam, The Netherlands
[2]Department of Internal Medicine, Division of Infectious Diseases, Center for Infection and Immunology Amsterdam (CINIMA), Academic Medical Center (AMC), Amsterdam, The Netherlands
[3]Department of Medical Microbiology, Section of Clinical Virology, Academic Medical Center (AMC), Amsterdam, The Netherlands
[4]STI AIDS Netherlands, Amsterdam, The Netherlands
[5]Department of Gastroenterology and Hepatology, Academic Medical Center, Amsterdam, The Netherlands
✉ fzuure@ggd.amsterdam.nl

## Introduction

Hepatitis C virus (HCV) infection is a global health problem; about 80-100 million individuals worldwide are chronically infected and at risk for progressive liver disease [4]. Every year, 499,000 deaths from HCV infection occur and the burden of disease continues to rise [1]. HCV is predominantly found among migrants, people who inject drugs (PWID), and HIV-positive men who have sex with men (MSM; [8]). However, in the Netherlands, unlike in many other countries, transmission currently occurs primarily among HIV-positive MSM as HCV incidence dropped to nearly zero among PWID [3]. Since 2000, there has been an unexpected and substantial increase in acute HCV infections among HIV-infected MSM. As HIV-HCV coinfection increases the risk of both HCV and HIV related mortality, and spontaneous clearance is rare in this population [2, 6], this spread of HCV is of great concern. Since 2015, efficacious and well tolerable new antiviral agents for the treatment of HCV have become widespread available in the Netherlands, making cure possible in the majority of chronically infected patients. Hence, early testing and treatment of HCV-infected HIV-positive MSM in combination with upscaling of preventive measures may curb the HCV epidemic among this population. We combined expertise and knowledge from virologists, mathematical modelers, clinicians, public health specialists, eHealth specialists and a non-governmental organization specialized in sexual health, in the MC Free (*Amsterdam MSM Hepatitis C Free*) project: aiming to develop an innovative, integral strategy to eliminate HCV among MSM in Amsterdam.

## Project outline

Since the elimination of HCV transmission among MSM is determined by the extent to which HCV infections can be diagnosed on time, successfully treated or prevented alltogether, we plan to intervene outside the clinical settings in the MSM community, aiming at MSM at risk for HCV. This strategy will be aligned and closely linked to e-health interventions that aim to increase HCV awareness, promote risk reduction behavior and willingness to test by using tailored persuasive online communication and personalised advice on risk behavior and testing options.

One of the interventions will be a low-cost internet-guided home-based testing service for HCV-RNA (home-collection testing involving a certified laboratory). This service allows men at high risk for HCV infection to take control and test on a regular basis using a highly sensitive test for the detection of acute HCV infection. Home-based testing can decrease barriers to testing as it increases convenience, anonymity, perceived control over the testing procedure and patient autonomy and control over their own health, and decreases time and efforts needed to visit regular health care facilities. We hypothesize that a home-based HCV-

RNA testing service for MSM at risk, combined with adequate motivating online information, instructions, counselling and linkage to care, may increase test uptake and test frequency and may lead to earlier diagnosis and treatment of HCV infection among HIV-infected and HIV-undiagnosed MSM compared to current standard care.

For the development of the home-based testing service we use the ceHRes Roadmap [7], a framework that guides the development of sustainable eHealth technologies. A project website is currently being developed (www.Ctest.nl). Website visitors are offered information regarding HCV-RNA testing and a risk assessment tool (a previously validated questionnaire [Newsum, in press]). This evidence-based tool advices whether HCV-RNA testing is necessary. Individuals can purchase a HCV-RNA home-collection test package including a test kit and a login for online instructions and counselling. Test packages will be sent to a chosen address, and users are instructed to send their self-collected dried blood spot obtained from a finger stick to the laboratory of clinical virology of the AMC for HCV-RNA testing. This method has been validated and shown to be effective [5]. Test results are communicated via a personal login at the project's website, and online personalized counselling will start immediately. The website will guide users who test positive directly towards additional steps to take, motivating them (a) to access regular health care for further evaluation and medical follow-up as soon as possible, and (b) to initiate partner notification. An online partner notification service will be offered. Post-test counselling for HCV-RNA negatives will address risk-reduction strategies using a tailored approach. We aim to stimulate frequent testing by offering test subscriptions (i.e., tests to be used every three months).

The home-based testing service will be primarily promoted via HIV-clinics in the Netherlands; in order to increase its reach we will also set up a campaign using existing information channels and networks for MSM, STI-clinics and peer-to-peer promotion. In close consultation and collaboration with target group representatives, we will develop online features that enable and stimulate users of the testing service to link members of their social network to the website and testing service. The ultimate goals of this feature are (1) to attain a viral effect and increase the reach of the testing intervention and (2) to penetrate networks of MSM at high risk for HCV and reach individuals within these networks who are not easily reached by conventional recruitment strategies Examples of such features are the option for users of the test service to send others a discount code or unique link that can be used to get a test for free or at a discounted rate.

The website will be launched in Spring/Summer 2017. We aim to distribute 1000 tests to MSM at high risk of HCV infection. We will evaluate the effectiveness of the interventions (e.g., the use of the testing service, prevalence, linkage to care, treatment initiation, use of partner notification services, user experience of the online interventions, etc.). When succesful, this approach can be expanded to other European cities that face a similar epidemic among HIV-positive MSM.

## References

1. Burki T. Elimination on the agenda for hepatitis C. Lancet Infect Dis. 2014;14:452-3
2. Chen TY, Ding EL, Seage Iii GR, Kim AY. Meta-analysis: increased mortality associated with hepatitis C in HIV-infected persons is unrelated to HIV disease progression. Clin Infect Dis. 2009 Nov 15;49(10):1605-15.
3. de Vos AS1, van der Helm JJ, Matser A, Prins M, Kretzschmar ME. Decline in incidence of HIV and hepatitis C virus infection among injecting drug users in Amsterdam; evidence for harm reduction? Addiction. 2013 Jun;108(6):1070-81.
4. Gower E, Estes C, Blach S, Razavi-Shearer K, Razavi H. Global epidemiology and genotype distribution of the hepatitis C virus infection. J Hepatol. 2014 Nov;61(1 Suppl):S45-57.
5. Tuaillon E, Mondain AM, Meroueh F, Ottomani L, Picot MC, Nagot N, Van de Perre P, Ducos J. Dried blood spot for hepatitis C virus serology and molecular testing. Hepatology. 2010;51(3):752-8.
6. van der Helm J, Geskus R, Sabin C, Meyer L, Del Amo J, Chêne G, Dorrucci M, Muga R, Porter K, Prins M; CASCADE collaboration in EuroCoord. Effect Of HCV Infection On Cause-Specific Mortality Following HIV Seroconversion Before And After 1997. Gastroenterology 2013;144:751-760.

7. van Gemert-Pijnen JE1, Nijland N, van Limburg M, Ossebaard HC, Kelders SM, Eysenbach G, Seydel ER. A holistic framework to improve the uptake and impact of eHealth technologies. J Med Internet Res. 2011 Dec 5;13(4):e111. doi: 10.2196/jmir.1672.
8. Vriend HJ, Van Veen MG, Prins M, Urbanus AT, Boot HJ, Op de Coul EL. Hepatitis C virus prevalence in The Netherlands: migrants account for most infections. Epidemiol Infect 2013; 141:1310-1317.

# Doctoral Consortium Papers

## Doctoral Consortium Chairs


| | |
|---|---|
| Jaap Ham | Eindhoven University of Technology, The Netherlands |
| Cees Midden | Eindhoven University of Technology, The Netherlands |
| Luciano Gamberini | University of Padua, Italy |

# Towards Improving E-commerce Users Experience Using Personalization & Persuasive Technology

Ifeoma Adaji

University of Saskatchewan, Saskatoon, Canada
✉ Ifeoma.adaji@usask.ca

**Abstract.** With the increase in the number of e-commerce companies, e-businesses need to identify ways and means of engaging their online customers and improving their experience while shopping with them. Personalization and persuasive technology have been identified as methods through which e-businesses can engage their existing clients and make new ones. To contribute to ongoing research in this area, my thesis aims to develop a framework that can create a customized shopping experience for clients using their personality traits, shopper type and persuasive technology. The result of this thesis can contribute to ongoing research in development of personalization and persuasive strategies that work in e-commerce especially for new companies.

**Keywords:** E-commerce, Persuasive Systems Design (PSD)

## Introduction

Because of the success of e-commerce, there has been an increase in the number of companies who do business online, with consumers spending more time online. Due to this increase, there is currently a lot of competition among e-businesses to acquire new customers and to maintain existing ones [1]. Companies, especially new ones, have to put strategies in place in order to remain attractive to their clients by creating a customized and relevant shopping experience for their customers.

This research aims at developing a framework that will create a more personalized experience for customers with the aim of increasing the success of new e-businesses using persuasive technology and personalization strategies.

## Research plan and methodology

This thesis proposes a framework to personalize clients' online shopping experience using persuasive technology, shopper types and personality traits. In particular, I propose to identify the shopper type of individuals and their individual personality traits and match these to the persuasive strategy that works best for them in a given context. Shopper types are important because they help companies effectively tailor products and services to the various segments of customers [2]. Personality traits are the features of a person's personality that make him/her different from the next person. Personality traits have been shown to influence consumer's online purchase decision, hence tailoring an e-commerce platform to an individual's personality type will likely increase the chances of the consumer shopping with that vendor [3]. Despite the various frameworks for shopper types and personality traits, none have been evaluated and matched with the persuasive strategies that work best for them. Using a framework like the Persuasive Systems Design (PSD) framework, this thesis aims to map the shopper types and personality traits of users to the persuasive strategy that works best for them and to evaluate the results in an e-commerce setting.

## Results so far

So far, I have identified the persuasive principles of the PSD framework that were implemented in a successful e-commerce platform [4]. In addition, I investigated these principles and how they affect the continuance intention of users in e-commerce [5] . In particular, I investigated the factors that affect the perceived effectiveness, credibility and continuance intention for use of e-commerce systems through the prism of the PSD framework. Using Amazon as a case study

and a sample size of 324 Amazon shoppers, I developed and tested a research model using partial least-squares structural equation modelling (PLS-SEM) analysis to. The results show that perceived effectiveness of an e-commerce company like Amazon is a great predictor of continuance intention. In addition, social support and primary task support are strong predictors of perceived effectiveness. Furthermore, dialogue support significantly influences perceived product credibility and perceived review credibility and both constructs are strong predictors of system credibility.

## Future work

In the future, I plan to map the identified persuasive principles (described in section 3) to users based on their personality traits and shopping type. In order to achieve that, I am currently carrying out a user study to identify the shopping types of users in e-commerce and to match these to personality traits using the Big Five trait taxonomy [6]. These will then be mapped to the persuasive principles of the PSD that work best for them.

## References

1. "How to win online: Advanced personalization in e-commerce; An Oracle white paper," 2011.
2. J. Rohm and V. Swaminathan, "A typology of online shoppers based on shopping motivations," *J. Bus. Res.*, vol. 57, no. 7, pp. 748–757, 2004.
3. R. Barkhi and L. Wallace, "The impact of personality type on purchasing decisions in virtual stores," *Inf. Technol. Manag.*, vol. 8, no. 4, pp. 313–330, Nov. 2007.
4. I. Adaji and J. Vassileva, "Evaluating Personalization and Persuasion in E-Commerce," *Proc. Int. Work. Pers. Persuas. Technol.*, 2016.
5. I. Adaji and J. Vassileva, "Perceived Effectiveness, Credibility and Continuance Intention in E-commerce. A Study of Amazon," in *Proceedings of 12th International Conference on Persuasive Technology*, 2017.
6. O. John and S. Srivastava, "The Big Five trait taxonomy: History, measurement, and theoretical perspectives," *Personal. Theory Res.*, 1999.

# Behavior Change Support System for Depression Prevention in Knowledge Workers

Franziska Burger[1], Willem-Paul Brinkman[1], & Mark A. Neerincx[1,2]

[1]Delft University of Technology, The Netherlands
[2]TNO, The Netherlands
✉ {f.v.burger, w.p.brinkman, m.a.neerincx}@tudelft.nl

**Abstract**. Surveys have found junior researchers to exhibit a high prevalence of depressive symptoms. Researchers and clinicians are increasingly exploring and using technology for mental health interventions in practice. While many reviews and articles have compared intervention features, such as different therapeutic interventions, few have regarded the impact of specific software features, such as types of persuasive elements. We aim to fill this gap by first creating an open-access database of state-of-the-art systems and subsequently authoring a literature review. We further intend to focus on gaining a better understanding of and creating a model for adherence in these interventions.

**Keywords**: eHealth, depression, adherence, persuasion profiling

## Introduction

Surveys conducted at the University of California, Berkeley [4], across Flemish universities in Belgium [3], and at the University of Amsterdam [1] have shown a significantly higher prevalence of early signs of depression among students and junior researchers than in the highly educated general population.

Depression is frequently associated with worse physical health and greatly impacts work efficacy. A promising possibility for learning methods to preventing and treating depression is through the use of technology. As nearly every review article in the field emphasizes, there is a great need for computerized and preferably therapist-independent support for mental health patients since technology has a far wider reach, does not require trained experts, is cheaper, has no wait-list, and has fewer social and societal barriers. We therefore propose to tackle the problem of work-related, subclinical depression in knowledge workers through the development of a coaching technology for health behavior change. Importantly, we aim to take a technical perspective rather than a psychological one: what are the technological/persuasive features of eHealth systems for depression treatment and prevention that contribute to their effectiveness? Can we model how technological features, intervention features, and user characteristics combine to shape adherence? How can we use such a model in the context of a digital therapist or coach to influence adherence?

## Related Work

Behavior change support systems (BCSS) for mental health are increasingly gaining merit. In reviews and meta-analyses, it is often attested that face-to-face therapy is not more effective than computerized therapy (compare [2] specifically for depression). In terms of the specific features that make these interventions effective, however, research is still sparse. Only one article [5] could be identified in which the authors attempted to determine the most helpful software features of an online intervention for depression, anxiety, and stress. However, the features are, to some degree, specific to the system and therefore the results do not easily generalize to other systems. We thus posit that there is a substantial need for identifying which software features are potent in terms of leading to effectiveness and adherence to eHealth interventions and in which contexts this is the case. It is within the framework of this research project that we strive to start filling this gap.

## Method and Vision

We devote the first year of this PhD project to establishing a solid foundation for the years to come. An important first milestone in the project is a review and meta-analysis of the literature concerning the state-of-the-art in BCSS for depressive disorders with a specific focus on the software features of these systems. To this end, we intend to develop an open-access database of existing systems, their software features, and, where available, their outcome measures.

An important second milestone is a white paper to detail the research objectives for the remainder of the project, particularly with regard to the development and evaluation of a model for preventing depression in knowledge workers. Here, we intend to focus on adherence: how and when to best cue system users to ensure that they neither ignore the cues nor get annoyed by them. To this end, we foresee the use of a general model that is increasingly personalized, using persuasion profiling, to provide the right cues at the right time for the right user as data from this user becomes available.

## References

1. Daas, R., Munneke, G.J., Bray, H., Goswami, M., ten Berg, J.: UvAPro PhD Survey 2015: Are UvA PhD candidates at risk of depression? (2016)
2. Foroushani, P.S., Schneider, J., Assareh, N.: Meta-review of the effectiveness of computerised cbt in treating depression. BMC psychiatry 11(1), 1 (2011)
3. Levecque, K., Anseel, F., Gisle, L., Heyden, J.V.D., Beuckelaer, A.: De mentale gezondheid van doctorandi in Vlaanderen (2016)
4. Panger, G., Tryon, J., Smith, A.: Graduate Student Happiness and Well-being Report (2014)
5. Whitton, A.E., Proudfoot, J., Clarke, J., Birch, M.R., Parker, G., Manicavasagar, V., Hadzi-Pavlovic, D.: Breaking open the black box: Isolating the most potent features of a web and mobile phone-based intervention for depression, anxiety, and stress. JMIR mental health 2(1) (2015)

# Design Smart Products

Vanessa Julia Carpenter

Aalborg University, Copenhagen, Denmark
✉ vjc@create.aau.dk

As part of the 3-year project called “Design Smart Products” run by Vanessa Julia Carpenter of IdemoLab, DELTA (**D**anish **E**lectronics **L**ights **T**esting **A**coustics), this industrial PhD proposes to explore how we as Interaction Designers, User Experience Designers, Engineers, and others create “Smart Products”. The primary focus is in enabling meaningful interactions, namely, **smart products which enable meaningful experiences**; smart products which people want to keep, and which outlive the ‘gadget’ lifetime of so many of today’s products.

Within the field of smart product development, there is much hype around the creation of internet enabled devices; companies are eager to implement “smart devices” and there is an increasing need to understand that “it won’t be enough to focus on the product features customers will pay the most for” (Bughin, J. et al., 2015) but rather the why of creating these devices is important to incorporate. This is especially the case with an IoT (Internet of Things) device, with the release of articles such as McKinsey’s “By 2025, Internet of things applications could have $11 trillion impact” (Manyika, J. & Chui, M., 2015). Companies in Denmark are driven towards GTS institutes (Approved Technology Companies / Godkendte Teknologiske Serviceinstitutter) such as DELTA for help with creating these new devices. Alongside the potential financial benefit of creating these new devices, the abilities of Interaction Designers, Engineers and others in this field have greatly increased with the available technologies, namely new sensors, new actuators, and many open source platforms on which to build these new products and interactions (Kasperkevic, J., 2013).

This PhD aims to begin by exploring the current field of Interaction Design, to investigate which theories are being applied commercially and what we can learn from these, and where meaning-making has been investigated and implemented. One such exploration can begin with what McCarthy et al explain about things which are meaningful: "The form and digital potential of the piece refer to objects, memories, human connections, and experiences, which are described as personally precious or meaningful by the participant." (McCarthy et al., 2006).

As a starting point, it can be said that the project problem is how to identify what “meaningful” means in terms of developing smart products; and also, how these smart products can be considered successful in terms of enabling meaningful experiences. The term meaningful is open to much interpretation and for the sake of this PhD, the focus will be on the domain of Interaction Design, finding examples within the field, and both applying these and exploring in what other ways meaningful can be used as a term to define the design, use and lifetime of a product.

**From here we explore some research questions:**

- ‘What does it take to design smart products that do not necessarily depend on a screen?’
- ‘How can designers today create smart products that connect humans to each other, through non-visual mediums?'
- ‘How can designers of smart products avoid the pitfall of ephemeral designs, and create products that aim to stand the test of time?’
- ‘How can designers and engineers work together to create meaningful devices which are brought to market and adopted in the real world?’
- ‘Which methodologies are required to create such devices?’

- ‘What type of partners are needed, and which work constellations are necessary to bring meaningful devices to market?’

**Methodological needs:**
- Assessing reactions of potential companies and users of meaningful devices
- Definition of the meaningfulness and usefulness of a product
- Assessing the effect of adopting meaningful devices
- Assessment of the potential and impact of interactivity with non-visual mediums or non-screen devices
- Assessment of the usefulness of a framework for the design of meaningful smart products

**Results so far:**
A state-of-the-art investigation into meaningfulness revealed that significant research exists around the term ‘meaningful’ or ‘meaningfulness’ in the domain of Psychology, but it is not significantly noticeable in the domain of Interaction Design. Therefore, the author has focused on similar studies such as “Designing for Happiness” (Hassenzahl et al, 2013) and “Designing for Authenticity” (Su and Stolterman, 2016).

Initial work done by the author and collaborators includes the creation of 11 jewellery devices (wearables) which sought to enable meaningful, non-screen, subtle interactions. The most relevant in terms of designing for meaningfulness has been submitted to conferences for review (and are currently awaiting reply). An example of one of these is a pregnancy wearable for pregnant women’s partners, which allows the partner to feel the baby’s movement in real time, via a wearable device. Currently, the author is looking further into haptics, and how combining designing for meaningfulness with haptics might have an impact on personal wellbeing.

**References**

Bughin, J., Chui, M. and Manyika, J., 2015. An executive’s guide to the Internet of Things. McKinsey Quarterly, McKinsey&Company.

Jung H. 2011. Bardzell, S., Blevis, E., Pierce, J., and Stolterman, E.. How deep is your love: Deep narratives of ensoulment and heirloom status. International Journal of Design 5, 1 (2011).

Hassenzahl, M., Eckoldt, K., Diefenbach, S., Laschke, M., Len, E. and Kim, J., 2013. Designing moments of meaning and pleasure. Experience design and happiness. International Journal of Design, 7(3).

Kasperkevic, J. 2013. Demand for Smart Sensors Is On the Rise. Available at: http://www.inc.com/jana-kasperkevic/rising-demand-smart-sensors.html.

Manyika, J. & Chui, M., 2015. By 2025, Internet of things applications could have
$11 trillion impact. Available at: http://www.mckinsey.com/mgi/overview/in-the-news/by-2025-internet-of-things-appl...

McCarthy, J., Wright, P., Wallace, J. and Dearden, A., 2006. The experience of enchantment in human–computer interaction. Personal and ubiquitous computing, 10(6), pp.369-378.

Su, N.M. and Stolterman, E., 2016, June. A Design Approach for Authenticity and Technology. In Proceedings of the 2016 ACM Conference on Designing Interactive Systems (pp. 643-655). ACM.

# Design for Supporting Sustainable Behaviour Retention through Context Change

Wanjun Chu & Renee Wever

Department of Management and Engineering, Linköping University, Sweden
✉ {chu.wanjun, renee.wever}@liu.se

## Background and Research Questions

The socio-economic transitions in developing countries and emerging economics have led to context changes in almost every aspect of individuals' life, resulting in undesired behaviour shifts from subsistence to consumption, such as from public transportation to private automobile, from energy and food conservation to waste. Retaining people's existing sustainable consumption behaviour through the transition process into the new lifestyle is of crucial urgency for these countries to leapfrog towards a sustainable future [1]. The habit discontinuity hypothesis points toward context of life course changes as a moment where the existing habits of individuals become disrupted [2,3]. While context change can open up a window to break certain undesired behaviour, the existing desired behaviour also can be disrupted and its retention may be supported through interventions as well. Therefore, context change can be seen as a challenge and a promising opportunity to persuade people to retain sustainable consumption behaviour before unsustainable behaviour become embedded in daily life.

However, as most of the existing studies in the field of Persuasive Technology have focused in generating design knowledge and strategies to support desired behaviour change in given contexts, there has so far been little attention to study how to persuade people to retain their existing sustainable consumption behaviour through context change, especially for implementing design interventions in developing countries. This study takes the aim above and is broken down into two research stages:

Stage 1: To understand why people retain some behaviours and change others through context change.

- What are the relevant theoretical perspectives to understand behaviour retention through context change?
- Given the theoretical background, what are the individual and contextual factors that affect behaviour retention? And how can these factors inform the design?

Stage 2: To explore how to design product and service to support users in retaining sustainable behaviour and outcome through context change.

- What are the design interventions and where to introduce these interventions to support sustainable behaviour retention? How to incorporate them into product and service design process?

## Research Plan and Current State

First, in order to identify the individual and contextual factors that affect behaviour retention, a theoretical framework will be developed by reviewing literatures related to persuasive technology and behaviour transition from both social-psychology per-spective and social-practice perspective. Then, I intend to collect qualitative data by applying the theoretical framework to an Ethnographic Informed Design approach [4]. A pilot study about food consumption when international students move to Sweden, and case studies concerning behaviour patterns of Swedish households after residen-tial relocation will be conducted. Next, to implement and evaluate the persuasive design interventions, Research through Design method will be applied. I plan to focus on studying consumption behaviour of the emerging urban middle class in China with a specific interest in the domain of household

energy use. An initial idea is to design, develop and evaluate an interactive service application in users' mobile devices, which aims to support sustainable energy consumption behaviour retention regarding the use of household appliances. The research plan is illustrated as the figure below.

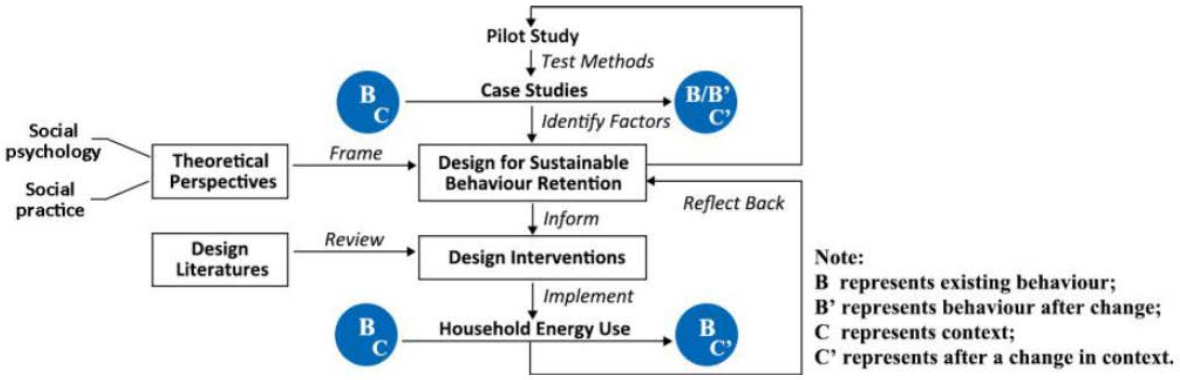


**Fig. 1**. An overall view of the research plan.

Currently, I am in the initial stage of research building the theoretical foundation and pilot study. At the time of the Doctoral Consortium, I expect to have the pilot study ready to illustrate my research. The study is expected to inform design opportu-nities and practices to support people who are going through context change to retain their sustainable consumption behaviour. It could possibly lead to a future discussion of how to adjust and apply behaviour design and persuasive strategies to solve a given sustainability problem in different social and cultural contexts.

## References

1. de Koning, J. I., Ta, T. H., Crul, M. R., Wever, R., & Brezet, J. C. (2016). GetGreen Vi-etnam: towards more sustainable behaviour among the urban middle class. Journal of Cleaner Production.
2. Verplanken, B., & Roy, D. (2016). Empowering interventions to promote sustainable life-styles: Testing the habit discontinuity hypothesis in a field experiment. Journal of Environmental Psychology, 45, 127-134.
3. Thomas, G. O., Poortinga, W., & Sautkina, E. (2016). Habit discontinuity, self-activation, and the diminishing influence of context change: Evidence from the UK understanding society survey. PloS one, 11(4), e0153490
4. Blomberg, J., & Burrell, M. (2009). An ethnographic approach to design. Human-Computer Interaction, 71-94.

# Adaptive Persuasive Games for Wellbeing

Ana Ciocarlan

University of Aberdeen, Aberdeen, United Kingdom
✉ ana.ciocarlan@abdn.ac.uk

**Abstract**. This research investigates the effectiveness of persuasive game interventions for health in motivating attitude and behaviour change to increase wellbeing and prevent symptoms of mental illness for students.

## Background and Research Questions

Mental health in universities is an important and growing concern in the UK, as approximately 75% of students report experiencing high levels of psychological distress during their academic career [7]. Stress, depression and anxiety are some of the most prevalent conditions among students and can lead to numerous health problems, as well as have a significant impact on students' motivation, confidence, engagement in learning, academic achievement and future opportunities. A novel approach in preventing psychological distress is using persuasion to promote the adoption of behaviours that support students in managing stressors effectively. We seek to create a persuasive game intervention to help individuals engage in meaningful, enjoyable and achievable goals and activities to increase their overall levels of life satisfaction and happiness and prevent mental ill health. Persuasive technologies and games encourage people to change their attitudes and behaviours through the use of a wide range of persuasive strategies and can become more effective if they are personalised [3, 6]. Some of the most commonly employed strategies in the design of behaviour change interventions have been identified by Fogg [2], Cialdini [1], and Oinas-Kukkonen [8]. Building on these strategies, an increasing number of persuasive games for health have been developed. For example, the Diab game encourages healthy eating and physical activity to prevent diabetes and obesity among adolescents [10], Re-Mission improves self-efficacy in young adults undergoing cancer treatment [4] and Orji [9] investigated personalising to gamer types to motivate healthy eating.

Despite the growing interest in persuasive technologies for healthcare, there remains a need for further research into the different methods for designing and tailoring persuasive games targeted at enhancing mental health and subjective wellbeing. Our work will be inspired by research on positive psychology interventions and behavioural activation, such as Lyubomirsky et al.'s theories and models of wellbeing [5]. We will study the application of personalised strategies and game design elements to induce positive emotions and adapt persuasive techniques to motivate happiness-increasing behavioural, cognitive and volitional actions that suit the individuals values and interests. We will investigate the following research questions:

1. How can persuasive game interventions encourage students to change their attitudes and behaviours to improve wellbeing and prevent mental ill health?
2. How effective are the strategies implemented in motivating and sustaining behaviour change?
3. How can persuasive strategies and game design elements be personalised to different users and user groups' characteristics and actions?

## Research Plan, Methodology and Results Achieved

We analysed the state-of-the-art and reviewed literature pertaining to topics of behaviour change theories and persuasive interventions for human wellbeing. We are currently planning user studies involving quantitative and qualitative methods to identify and classify the primary student stressors and impactors for mental health (e.g. diet, exercise, social

interaction, stress management). We will personalise approaches to offer support and inform through tailored game dialogue, induce positive moods and manage the impactors in different user groups constructed around common characteristics. The outcomes of our studies will allow us to build a comprehensive model of mental health and wellbeing behaviour determinants to account for all identified impactors. We will design algorithms and implement a game-based behaviour change intervention inspired and validated through the findings obtained from our studies and controlled experiments, theory and literature. Finally, we will perform user evaluations to review the effectiveness of the system in changing attitudes and behaviours to support the improvement of wellbeing and prevention of mental illness.

## References

1. Cialdini, R.: The Psychology of Influence and Persuasion. NY Quill, NY (1991)
2. Fogg, B.J.: Persuasive Technology: Using computers to change what we think and do. Morgan Kaufmann, San Francisco (2003)
3. Kaptein, M., De Ruyter, B., Markopoulos, P., Aarts, E.: Adaptive persuasive systems. ACM Transactions on Interactive Intelligent Systems 2(2), 10:1–10:25 (2012)
4. Kato, P.M., Cole, S.W., Bradlyn, A.S., Pollock, B.H.: A video game improves behavioral outcomes in adolescents and young adults with cancer: a randomized trial. Pediatrics 122(2), e305–e317 (2008)
5. Lyubomirsky, S., King, L., Diener, E.: The benefits of frequent positive affect: Does happiness lead to success? Psychological Bulletin 131(6), 803–855 (2005)
6. Masthoff, J., Grasso, F., Ham, J.: Preface to the special issue on personalization and behavior change. UMUAI 24(5), 345–350 (2014)
7. Nightline Association: Psychological distress in the UK student population: Prevalence, timing and accessing support (2014)
8. Oinas-Kukkonen, H., Harjumaa, M.: A systematic framework for designing and evaluating persuasive systems. In: Persuasive Technology Conf. pp. 164–176 (2008)
9. Orji, R.: Design for behaviour change: a model-driven approach for tailoring persuasive technologies. Ph.D. thesis, University of Saskatchewan, SK, Canada (2014)
10. Thompson, D., Baranowski, T., Buday, R., et al.: Serious video games for health how behavioral science guided the development of a serious video game. Simulation & Gaming 41(4), 587–606 (2010)

# Persuasive Technologies for Attention-Deficit Hyperactivity Disorder (ADHD)

Marcelo C. Halpern

Universidade Federal do Rio Grande do Sul — UFRGS, Porto Alegre, Brazil
✉ marcelo.halpern@gmail.com

**Abstract.** In recent decades, technology based approaches applied to behavioral contexts of health and wellness have been recurrent subjects of research and development [1, 2]. Factors such as universal access to technology have enhanced the number of technology-mediated psychological interventions, representing a new perspective over mental illness treatment [3], including Attention-Deficit Hyperactivity Disorder (ADHD) [2]. The present research aims to understand how persuasive technology can benefit patients with ADHD.

ADHD is one of the most thoroughly researched mental disorders, affecting approximately 5% of children and adolescents worldwide [4]. Despite being commonly diagnosed in childhood, it is considered a chronic condition that persists into adulthood in 65% of cases. The cardinal symptoms are inattention, hyperactivity, and impulsivity, which can impair the functional and emotional development of individuals [4]. Treatment is multimodal, with behavioral therapies having a critical role in its adherence and maintenance, focusing on reducing and managing the symptoms [2, 5].

Current literature points to a myriad of products and technological approaches towards ADHD focused on direct patient care or support for providers and systems [2], ranging from self-monitoring and m-health platforms [6], computer-based cognitive training [7], and health information technology systems (HIT) [8]. Although several positive results point to the potential effectiveness of these technologies, the lack of evidence and in-depth studies about the outcomes are remarked. Moreover, there are conceptual product limitations, such as the shortage to address specifically to ADHD patient concerns, and the need to invest in user experience, long-term interest, and engagement features [2]. Considered a novelty approach towards the treatment and assessment of ADHD, the Research Domain Criteria (RDoC[1]) offers a domain-based framework which links neurobiological components to symptoms and behavioral issues resulting from mental disorders [9]. RDoC can help address specific aspects of symptoms and compromised behavioral areas in a more precise fashion, leading to the development of more accurate technological approaches [2, 9, 10]. Based on RDoC domains [10], a specific model to implement technology focusing on ADHD has been proposed by [2], addressing current findings organized in major components and suggesting specific guidelines for consumer technology development.

In order to pursue a better understanding of how persuasive technologies can benefit and improve ADHD patient treatment, this research will collect and validate data from patients, family members, and health professionals at the ProDAH[2], affiliated to the Hospital de Clínicas de Porto Alegre (HCPA/Brazil). This exploratory stage will identify the needs, opportunities, and specific unexplored scenarios for implementing persuasive technology in treatment. As methodological base, this research will use the RDoC constructs and domains [10], the Model to Implement Technology in ADHD [2], and the Persuasive System Design (PSD) framework [11] to develop and prototype a platform with therapeutic purposes. This research aims to answer the following questions:

[1] https://www.nimh.nih.gov/research-priorities/rdoc/
[2] https://www.ufrgs.br/prodah/en/

a) What ADHD behavioral challenges could benefit from persuasive technologies?
b) Which technologies and assets are most suitable for ADHD patients?
c) Which persuasive strategies could lead to effective and long-term engaging features in ADHD treatment context?

## References

1. Orji, R., Moffatt, K.: Persuasive technology for health and wellness: State-of-the-art and emerging trends. Health Informatics J. (September) (2016)
2. Benyakorn, S., Riley, S.J., Calub, C.A., Schweitzer, J.B.: Current State and Model for Development of Technology-Based Care for Attention Deficit Hyperactivity Disorder. Telemed. e-Health 22(March), tmj.2015.0169 (2016)
3. Carroll, K.M., Rounsaville, B.J.: Computer-assisted therapy in psychiatry: Be brave-its a new world (2010)
4. Polanczyk, G., De Lima, M.S., Horta, B.L., Biederman, J., Rohde, L.A.: The worldwide prevalence of ADHD: A systematic review and metaregression analysis. Am. J. Psychiatry 164(6), 942–948 (2007)
5. Gajria, K., Lu, M., Sikirica, V., Greven, P., Zhong, Y., Qin, P., Xie, J.: Adherence, persistence, and medication discontinuation in patients with attention-deficit/hyperactivity disorder - a systematic literature review. Neuropsychiatr. Dis. Treat. 10, 1543–69 (2014)
6. Spachos, D.: The Future of Mobile Health ADHD Applications (November), 279–282 (2015)
7. Sonuga-Barke, E., Brandeis, D., Holtmann, M., Cortese, S.: Computer-based Cognitive Training for ADHD. A Review of Current Evidence. (2014)
8. Baum, R.A., Epstein, J.N., Kelleher, K.: Healthcare reform, quality, and technology: ADHD as a case study topical collection on attention-deficit disorder. Curr. Psychiatry Rep. (2013)
9. Levy, F.: DSM-5, ICD-11, RDoC and ADHD diagnosis. Aust N Z J Psychiatry 48(12), 1163–69 (2014)
10. Baroni, A., Castellanos, F.X.: Neuroanatomic and cognitive abnormalities in attention-deficit/hyperactivity disorder in the era of 'high definition' neuroimaging (2015)
11. Oinas-kukkonen, H., Harjumaa, M.: Persuasive Systems Design: Key Issues, Process Model, and System Features. Commun. Assoc. Inf. Syst. 24(28), 485–500 (2009)

# Understanding the Effect of Persuasive Systems Design on Older Adults' Physical Activity Levels

Christina N. Harrington

School of Industrial Design
Georgia Institute of Technology, Atlanta, GA, USA
✉ cnh@gatech.edu

**Abstract.** My dissertation research focuses on refining existing persuasive design frameworks based on an understanding of psychological constructs associated with older adults engaging in physical activity. Although there has been an emergence of mobile health (mHealth) technologies intended to encourage physical activity through tracking and in-time feedback, low usage rates due to lack of motivational affordance and poor design consideration prevent benefits from being actualized. This area has yet to be explored from a perspective of leveraging the underlying constructs that lead to behavior change for older adults specifically.

**Keywords:** Older Adults, Persuasive Design Principles, Physical Activity (PA), Behavior Change

## Research Questions and State of the Art

Maintenance of health and physical well-being contribute to the overall quality of life for individuals as they age. Despite the known benefits of physical activity (PA), many older adults do not meet the recommended levels of exercise or PA, preventing the health benefits that are often seen from living an active lifestyle [1,2]. There has been an emergence of mHealth apps that encourage PA, many of which employ principles of persuasive design in their approach to encourage certain pre-determined behaviors based on the user's actions. The concept of Persuasive Systems Design [3] frames the various design techniques and principles used to achieve intended behavior change by supporting users through four psychological constructs of primary task support, dialogue support, system credibility support, and social support. Use of these technologies has the potential to increase PA in older adults, but are currently under-utilized, often due to lack of motivational affordance and poor design consideration [4,5]. Although persuasive design has potential to encourage healthy behaviors, it is unclear the longitudinal effect of this design approach, and how well user-reported constructs are integrated into existing design principles.

My dissertation research examines this approach to promote PA behavior change among older adults. I am interested in understanding how persuasive design can best support long-term behavior change such that older adults successfully initiate and sustain routine levels of PA and exercise? Associated research questions include:

RQ1-*What are the key factors that influence older adults initiating and sustaining recommended levels of PA?*
RQ2-*Which persuasive design principles are most relevant in addressing the needs of the older adult population, given limitations in ability and identified motivators (e.g., prior experiences,social support)?*
RQ3-*When applied to mHealth apps, how effective are relevant persuasive design principles in increasing and sustaining levels of PA from baseline performance and initial use of the technology?*

**Research Plan**

This dissertation research will investigate the ability of persuasive design techniques, when applied to mHealth apps, to increase PA among older adults. Two research studies make up this dissertation: an archival analysis of semi-structured interview data regarding constructs related to older adults' PA behaviors, results will identify motivating factors that can be translated to guide persuasive design principles and a framework for addressing this population; second, I will evaluate existing mHealth apps based on this framework. In addition to the presence of refined persuasive design principles, apps will be evaluated based on the UD-MIG [6] to attest to system usability and functionality as relevant to the older adult population. The last phase of my dissertation includes a semi-longitudinal study to assess effectiveness of mHealth apps to motivate older adults to initiate and sustain PA.

**Advancement State**

Qualitative interview data were analysed to look for emerging themes of factors related to older adults' PA levels. Preceding this phase, an exhaustive literature review was conducted in the areas of persuasive technologies to promote PA behaviors, persuasive technologies specifically designed for older adults, and behavioural science approaches to PA promotion. It would be very valuable to this stage of my research to receive feedback from academic faculty in the area on the best ways to approach derivation of persuasive system design guidelines based on the data we have collected and our analysis thus far.

**Expected Contribution**

Results of this study will inform a model of persuasive design for the aging population and evidence-based design guidelines for persuasive technologies effective in motivating behavior change among this population. It is of value to design and HCI research communities to explore this area by implementing evidence-based constructs through persuasive and universal design principles.

**References**

1. World Health Organization, 2010. Global Recommendations on Physical Activity for Health. http://whqlibdoc.who.int/publications/2010/978924 1599979_eng.pdf. Behavioral Risk Factor Surveillance System Survey Data, 2008. Retrieved from: http://www.cdc.gov/nccdphp/dnpa/physical/stats/index.htm).
2. Oinas-Kukkonen, H. & Harjumaa, M. (2009). Persuasive Systems Design: Key Issues, Process Model, and System Features. *Communications of the Association for Information Systems, 24*(28), 485-500.
3. Middelweerd A, Mollee JS, van der Wal CN, Brug J, Te Velde SJ. (2014). Apps to promote physical activity among adults: a review and content analysis. Int J Behav Nutr Phys Act.; 11:97.
4. Legris P., Ingham J., Collerette P. (2003). Why do people use information technology?
5. A critical review of the technology acceptance model. *Information & Management*, 40, 191-204.
6. Ruzic, L., Lee, S. T., Liu, Y. E., & Sanford, J. A. (2016, July). Development of Universal Design Mobile Interface Guidelines (UDMIG) for Aging Population. In *International Conference on Universal Access in Human-Computer Interaction* (pp. 98-108). Springer International Publishing.

# User- and Context-Adaptive Goal-Setting Support

Katja Herrmanny

Personal Analytics, Interactive Systems Research Group,
University of Duisburg-Essen, Duisburg, Germany
✉ katja.herrmanny@uni-due.de

## Motivation and State of the Art

Persuasive technology with the aim of encouraging physical activity can implement different behavior change strategies, such as goal-setting which in multiple studies has proven to be effective [1]. According to goal-setting theory [1] self-set, precise, challenging and achievable goals have a motivating effect. However, previous investigations on goal-setting in activity tracking applications showed that strategies to support users in finding an appropriate goal level are required [2,3]. Following psychological behavior change models, achieving goals and successful behavior change depend on a large number of variables such as barriers, facilitators, willpower, or goal commitment which makes (personalized) goal recommendation difficult. This might be the reason why most activity tracking systems with goal-setting described in literature, do not sup-port the user in defining their goal level or even just assign a fixed goal without considering personal factors [4,5,6,7]. Some systems employ first attempts of user-support in goal-setting, including the use of baseline performance and thresholds or the previous activity to suggest one of a few pre-defined goals or a pre-defined goal increase [8,9,10]. More elaborated approaches to suggest training plans use previous performance, fitness level, physiological and personal data [11,12]. However, none of these approaches directly takes into account motivational aspects that influence goal pursuit.

## Research Topic and Methodology

In my research I investigate how to support users in goal-setting in activity tracking systems by providing personalized, user- and context-adaptive goal recommendations. My aim is to develop an algorithm to quantify a challenging but not overburdening physical activity goal for a specific user and a specific time span. This requires the consideration of a wide range of variables that influence successful goal pursuit, such as abilities, barriers and facilitators, and especially motivational aspects of the user.

Methodologically, I follow the paradigm of design science [13]. Therefore, I use methods from computer science and psychology in an interdisciplinary approach. I began with a literature review to identify promising variables from psychological literature. Also empirical studies and further evaluations are part of my iterative development process. For the goal calculation, I will test a combination and modifications of different existing statistical and machine learning methods such as structural equation models, regression analysis, or neural networks. The application will be implemented as a smartphone app and empirically evaluated.

## Current Results and Next Steps

In a first step, I developed an algorithm that uses historical data (mean and record performance), age, and values from health science literature for goal recommendation and evaluated it in a 12-week field study ($n_{subjects} = 79$, $n_{weeks} = 206$) [3]. The core idea is that a motivating goal level lies between mean and record performance (i.e. the highest (known) performance the user is able to do). Evaluation results seem promising, but there is high inter- and intra-personal variance [3]. It especially lacks in considering time-dependent variations in health state, external conditions, and motivation/volition at short notice. Thus, for more elaborated goal recommendations, I identified potential further influencing variables and developed a model consisting of three pillars for goal calculation (see **Fig. 1**). The first pillar, *Performance Ability*, contains personal physical conditions and limitations, such as mean performance and physical limitations. The pillar of *Volitional Demand* includes performance

Adjunct Proceedings of the
12th International Conference on Persuasive Technology, April 3-6, 2017, Amsterdam, The Netherlands.

opportunities and realization condition, i.e. objective facilitators and barriers, such as free time or built environment. The third pillar, *Volitional Capacity*, includes psychological aspects influencing or representing motivation and volition, such as willpower, self-efficacy, and specific character traits.

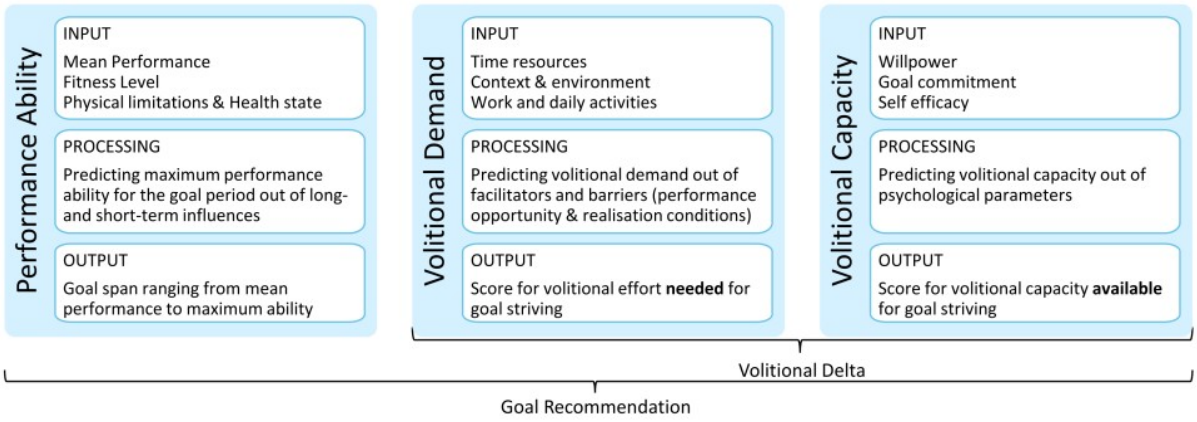


**Fig. 1.** Three Pillar Model

Performance Ability calculates a span in which the appropriate goal lies. As in the before-described initial approach this span normally ranges from the current mean performance to the highest performance, the user is able to do. However, an accurate value for the highest performance required a modification: Instead of the record performance, maximum ability now bases on physical conditions – e.g. health status and physical limitations – using a knowledge base from health science. To determine the appropriate goal level within this span, the *Volitional Delta* between the *Volitional Demand*, i.e. the volitional effort needed to be physically active, and the available *Volitional Capacity* are used (see **Fig. 1**). The higher the *Volitional Demand* and the lower the *Volitional Capacity*, the lower the goal recommendation out of the span and vice versa.

My next steps are to track the included variables and predict their value for the course of goal pursuit, validate the model and check for feature reduction. I will identify the variables' level of influence and interactions and develop a suitable algorithm to calculate a span/ score for each pillar and afterwards the goal recommendation. Moreover, I will represent the three pillars with a time-based component (as the values of the variables are changing) in a user model. Finally, I will implement and evaluate the algorithm and the system (formative and summative).

## References

1. Locke, E.A., Latham, G.P.: Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. American Psychologist 57 (9), 705–717 (2002)
2. Saini, P., Lacroix, J.: Self-setting of physical activity goals and effects on perceived difficulty, importance and competence. In: 4th International Conference on Persuasive Technology (Persuasive), pp. 33–39. ACM Press, New York (2009)
3. Herrmanny, K., Ziegler, J., Dogangün, A.: Supporting Users in Setting Effective Goals in Activity Tracking. In: Persuasive Technology. PERSUASIVE 2016. LNCS, vol. 9638, pp 15-26. Springer, Cham (2016)
4. Consolvo, S., Everitt, K., Smith, I., Landay, J.A.: Design requirements for technologies that encourage physical activity. In: SIGCHI Conference on Human Factors in Computing Systems (CHI), pp. 457–466. ACM Press, New York (2006)
5. Lin, J.J., Mamykina, L., Lindtner, S., Delajoux, G., Strub, H.B.: Fish'n'Steps: Encouraging Physical Activity with an Interactive Computer Game. In: Dourish, P., Friday, A. (eds.): UbiComp 2006. LNCS, vol. 4206, pp. 261–278. Springer, Heidelberg (2006)
6. Consolvo, S., Klasnja, P., McDonald, D.W., Avrahami, D., Froehlich, J., LeGrand, L., Libby, R., Mosher, K., Landay, J.A.: Flowers or a robot army? In: 10th international conference on Ubiquitous computing (UbiComp), pp. 54–63. ACM Press, New York (2008)
7. King, A.C., Ahn, D.K., Oliveira, B.M., Atienza, A.A., Castro, C.M., Gardner, C.D.: Promoting physical activity through hand-held computer technology. American journal of preventive medicine 34 (2), 138–142

(2008)
8. Bickmore, T.W., Caruso, L., Clough-Gorr, K.: Acceptance and usability of a relational agent interface by urban older adults. In: CHI '05 Extended Abstracts, pp. 1212–1215. ACM Press, New York (2005)
9. Burns, P.; Lueg, C.; Berkovsky, S.: Activmon: encouraging physical activity through ambient social awareness. In: CHI '12 Extended Abstracts, pp. 2363–2368. ACM Press, New York (2012)
10. King, A.C., Hekler, E.B., Grieco, L.A., Winter, S.J., Sheats, J.L., Buman, M. P. et al.: Harnessing different motivational frames via mobile phones to promote daily physical activity and reduce sedentary behavior in aging adults. PloS one 8 (4), e62613 (2013)
11. Bielik, P.: Personalized training plan recommendation and activity tracking for a healthier lifestyle. Bulletin of the ACM Slovakia 3 (4), 39–40 (2011)
12. Buttussi, F., Chittaro, L.: MOPET: A context-aware and user-adaptive wearable system for fitness training. Wearable Computing and Artificial Intelligence for Healthcare Applications 42 (2), 153–163 (2008)
13. Von Alan, R. H., March, S. T., Park, J., Ram, S.: Design science in information systems research. MIS quarterly, 28(1), 75–105 (2004)

# Generating Personalized Playable Content in Gamification

Reza Khoshkangini, Giuseppe Valetto, & Annapaola Marconi

Brain, Mind and Computer Science (BMCS), University of Padova and Fondazione Bruno Kessler (FBK), Trento, Italy
✉ {khoshkangini, valetto, marconi}@fbk.eu

**Abstract.** While gamification is often effective to incentivize and persuade its users to modify their behaviors and achieve certain set goals [1], well-known limitations concern sustaining users' interest, so that the new behaviors promoted through the game can be sufficiently reinforced over time to form new habits [2]. Hence, there is a need to devise techniques that keep users engaged in the long term.

**Keywords**: Gamifcation, Recommender system, Procedural content generation

## Research hypothesis

To improve engagement in gamification and sustain it over time, we propose the automated generation of personalized and contextualized units of playable content, which can appeal uniquely to each player, and which make her user experience with the gamified system more varied an individually compelling. Our hypothesis is that, by injecting these personalized playable units in a gamified system and assigning them to its users, we can improve sustained engagement and retention, and thus amplify the persuasive power of gamification.

## Approach

Our approach is rooted in a combination of Procedural Content Generation (PCG) and Recommendation Systems (RSs). PCG is increasingly used in the domain of electronic games [3], to computationally generate a wide variety of game elements, in order to enhance the player experience by increasing diversity, keep active the attention and curiosity of the player, and adapt the game to the player's personal preferences, abilities and playing style. RSs are information filtering systems, which try to predict what a user may prefer, choose or accept among a selection of items [4]. In particular, we have recently witnessed the emergence of Context-Aware Recommender Systems (CARSs), which strive to take into account the contextual information on the current situation of the user to optimize recommendations [5]. To our knowledge, such a combination of PCG and RSs is novel in gamification. To be effective, the generated playable units must fulfill two purposes: i) enhance the user experience, by being in accord with the player's preferences, contextually relevant to her current game status and objectives, and of balanced difficulty; and ii) further the gamification goals, that is, persuade players to act toward the behavioral change that is the "ulterior motive" of a gamified system.

## Preliminary results

We have built a CARS, which generates and recommends playable units in the form of individually personalized challenges. We model a challenge as the tuple <PL,G,D,C,P,W >. PL is the player to whom the challenge is assigned; G defines the goal, that is, a task or a performance target, which should be fulfilled to successfully complete the challenge; C is a constraint for reaching the goal, e.g. a deadline; D is an estimate of the difficulty of the challenge, given goal G and constraint C; P is the prize awarded for completing the challenge; finally, W is a weight that represents how relevant the task represented by the challenge is for the behavior being promoted via gamification.

Our prototype is outlined in Figure 1. The Challenge Generator and Challenge Valuator modules are in charge of PCG, i.e., to instantiate and fill challenge tuples like the one above. The Sorting and Filtering module implements a multi-criteria recommendation algorithm that picks - out of a wide set of generated challenges - the ones that are best suited to each player in the current game context. The Learning and Analysis module (in progress) uses Machine Learning on the performance with challenges over the history of the game, to assess what challenges are most likely to be accepted and successfully taken up by a player.

We have experimented with a prototype of our system during gamification campaigns aiming to incentivize sustainable urban mobility, which involved hundreds of citizen/players for several months [6]. Our preliminary evaluation based on these open-field studies is promising: the challenges generated and suggested by our system are very similar to the ones manually devised and assigned to players by expert game designers; moreover, in several cases they can be better accepted than the ones proposed by experts to the same players.

**Research plan**

The plan towards my doctoral dissertation consists of the following further steps:

- in-depth evaluation of the current CARS, based on the open-field experiments above;
- completion of the machine learning component, and design of a new experiment aiming at validating and evaluating its impact on quality and acceptance of suggested challenges;
- application and evaluation of the method and system to a different gamification domain and/or different kinds of playable units of content;
- consolidation and write-up of research results.

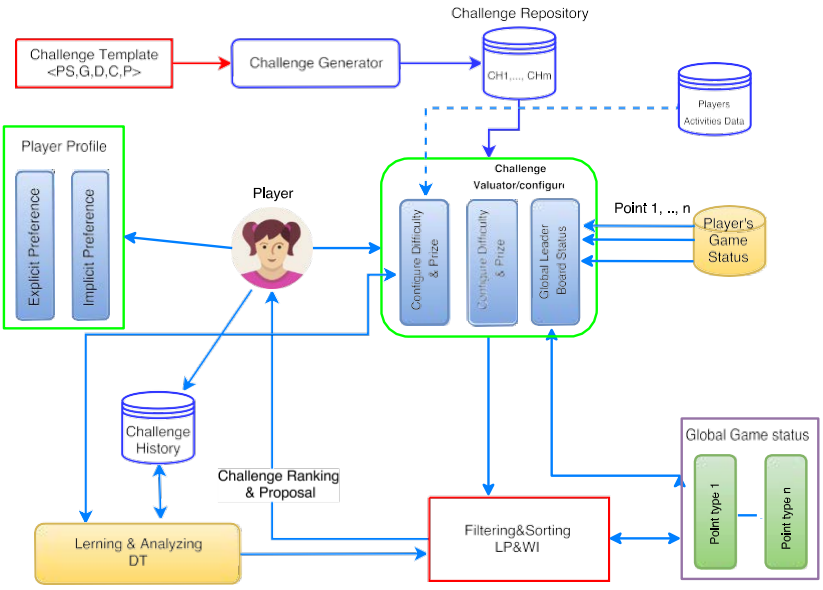


**Fig. 1**. The Challenge Generator frontend.

## References

1. J. Hamari, et al. Does gamification work? A literature review of empirical studies on gamification. In Proceedings of the 47th Hawaii International Conference on System Sciences (HICSS), 2014.
2. P. Weiser, et al. A Taxonomy of Motivational Affordances for Meaningful Gamified and Persuasive Technologies. In Proceedings of the 3rd Intl. Conference on ICT for Sustainability (ICT4S), Paris, France, 2015.
3. M. Hendrikx, et al. Procedural content generation for games: A survey. ACM Transactions on Multimedia
4. Computing, Communications, and Applications 9(1):1-22, 2013.
5. J. Lu, et al. “Recommender system application developments: a survey.” Decision Support Systems, June 2015. [5] Adomavicius, et al. “Incorporating contextual information in recommender systems

using a multidimensional approach". ACM Transactions on Information Systems (TOIS) 23(1):103–145, 2005.

6. R. Kazhamiakin, et al. A gamification framework for the long-term engagement of smart citizens. In Proceedings of the 2nd IEEE Intl. Smart Cities Conference (ISC2), 2016.

# Understanding Social Product Design

Katrine Kunst

Copenhagen Business School, Department of IT Management
Howitzvej 60, 2000 Frederiksberg, Denmark
✉ kalk.itm@cbs.dk

## Introduction & Related Work

This research investigates how the infusion of social information can be leveraged to create more persuasive products and services. By 'social information' I mean information about other (known as well as unknown) users' opinions and behaviors in regards to a specific product. It is motivated by the digitization of a diverse range of products and services (i.e. books, music, hotel booking etc.), which significantly increases the potential for observing not only other users' opinions (e.g. through reviews), but also other users' behaviors in regards to that product [4, 9, 10]. An illustrative example is music service Spotify, which allows users to see what their connections are listening to right now/have been listening to lately, i.e. how they behave in regards to the service. This development is extremely interesting, given the widely recognized propensity of people to be influenced by the behaviors of other people, also known as 'observational learning' (OL) [2]. In this context, and building on Fogg's functional triad of Persuasive Technology [7], the integration of social information in products and services can be viewed as a persuasive tool (helping users find the right content), and as a social actor (using the presence of social others to provide social proof of the quality). Against this backdrop, it's surprising that very few companies beyond dedicated social networking services have succeeded in making a truly social product experience, where customers have access to information about friends' product-related opinions and behaviors. To address this seemingly paradox, I put forth the following research questions:

*RQ1: How does the integration of friend-specific social information impact consumer attitudes towards, and intention to use, an online service?*
*RQ2: How do users make sense of and appropriate social information in an online service?*

Related to the above, the notions of 'Viral Product Design' [1] and 'Social Design' [3] have attracted academic attention in later years. Both describe how the use of social features in products and services can be used to diffuse a product [1] or to "help with initial adoption, sustained engagement, and user retention" [3, p. 1903]. A number of empirical studies have investigated the effects of including such social information in products and services [e.g. 4, 5, 12], and generally find that both behavior-based and opinion-based information positively increases adoption/sales and/or continued usage. The topic has, however, mainly been approached from a large-scale experimental angle, where scholars have tested social features already available in the market. Consequently, following the call of Fogg [6] to create insights on what could and should exist in terms of Persuasive Technology, in this project I seek to contribute to extant literature as well as practice by 1) developing and evaluating new types of social information to increase the persuasiveness of an online service and 2) investigating the topic of social product design from a qualitative approach to address the unknown issue of how users actually make sense of and appropriate different kinds of social information. The overall aim is to develop a framework for design of social products and services to guide both practitioners in their quest for designing persuasive products and services, and to provide a structure for academics to guide their research.

## Methodology & Initial Results

I deploy a mixed-method approach, combining 1) netnographic content analysis and literature review 2) an online, controlled field experiment, and 3) qualitative method with in-depth

interviews.

***Study 1***: In this study, our focus was on understanding and conceptualizing the many new types of behavior-based social information which have been made possible by digitization. The method was a netnographic content analysis combined with a literature review of extant literature on (electronic) Word of Mouth (WOM and eWOM). The result is the conceptualization and categorization of a new, technology-enabled kind of behavior-based social information, which I coin 'Electronic Word of Behavior' (eWOB), and define as "The observable online traces of consumers' behaviors" [8]. Although completed, I plan to update the literature review and parts of data to enrich the final result.

***Study 2***: This study was carried out as a small-scale controlled field experiment in collaboration with a Danish movie streaming service. We took an Action Design Research [13] approach and built a 'social integrator', which allowed us to not only integrate friend-specific information into a website, but also into a survey built for this project. This made it possible to test users' reactions to new types of social information (and combinations hereof), which we derived from theory, but which are not currently available to product designers. We are in the process of writing up the results, which indicate that social information seems to have an impact on potential users' attitudes and intended behaviors, especially when exposed to opinion-based social information from a high number of category-specific influential friends. The effect is, however, marginal, which means that only a few statistically significant results can be found. These results, and the design process as a whole, do however provide insights that lays the groundwork for the development of a conceptual framework and design principles for social product design.

***Study 3***: In line with the Persuasive Systems Design framework [11] the aim of this study is to understand the 'persuasion context' of an online content-based service. More specifically, the focus will be on investigating how different types of users make sense of and appropriate social information about friends' behaviors and opinions. The idea is that pieces of social information in an online service might be made sense of and used differently among different types of users. Thus, in order to design solutions that successfully change attitudes and/or behaviors, we need also to understand the real use-case of users. Spotify will most likely be used as a case, since it represents a service that offers users the option to opt in or out of social features. The insights from this study will also feed into the overall framework for social product design.

## References

1. Aral, S., Walker, D.: Creating Social Contagion Through Viral Product Design: A Randomized Trial of Peer Influence in Networks. Manage. Sci. 57, 9, 1623–1639 (2011).
2. Bandura, A.: Social foundations of thought and action: A social cognitive theory. Prentice-Hall, Englewood Cliffs, NJ (1986).
3. Bapna, R., Umyarov, A.: Do Your Online Friends Make You Pay? A Randomized Field Experiment on Peer Influence in Online Social Networks. Manage. Sci. 61, 8, 1902–1920 (2015).
4. Chen, Y. et al.: Online Social Interactions: A Natural Experiment on Word of Mouth Versus Observational Learning. J. Mark. Res. 48, 2, 238–254 (2011).
5. Cheung, C.M.K. et al.: Do actions speak louder than voices? The signaling role of social information cues in influencing consumer purchase decisions. Decis. Support Syst. 65, 50–58 (2014).
6. Fogg, B.J.: Persuasive Technologies. Commun. ACM. 42, 5, 26–29 (1999).
7. Fogg, B.J.: Persuasive Technology: Using Computers to Change What We Think and Do. Morgan Kaufmann Publishers (2003).
8. Kunst, K.: Electronic Word of Behavior: The Mediating Role of Social Media in Disclosing Otherwise Non-observable Product-related Behavior. In: Proceedings of the 44th Annual conference of the European Marketing Academy. EMAC, Brussels (2015).
9. Libai, B. et al.: Customer-to-Customer Interactions: Broadening the Scope of Word of Mouth Research. J. Serv. Res. 13, 3, 267–282 (2010).
10. Liu, D. et al.: Friendships in online peer-to-peer lending: pipes, prisms, and relational herding. MIS Q. 39, 3, 729–742 (2015).

11. Oinas-Kukkonen, H., Harjumaa, M.: Persuasive Systems Design: Key Issues, Process Model, and System Features. Commun. Assoc. Inf. Syst. 24, 28, 485–500 (2009).
12. Salganik, M.J., Watts, D.J.: Leading the Herd Astray: An Experimental Study of Self-fulfilling Prophecies in an Artificial Cultural Market. Soc. Psychol. Q. 71, 4, 338–355 (2008).
13. Sein, M. et al.: Action Design Research. Manag. Inf. Syst. Q. 35, 1, 37–56 (2011).

# Designing Persuasive Play Experiences for Children's Collective Physical Activity

Yudan Ma

Department of Industrial Design, Eindhoven University of Technology, The Netherlands
✉ Y.Ma@tue.nl

## Introduction

Physical activity in education aims at total child development, which means components like physical, social, emotional, and intellectual are all of importance to children's well-being [1]. Collective physical activity contributes to communication and regular exercise routine [2]. This research aims to motivate children's collective participation by means of designing playful and persuasive interaction. Further, social engagement could sustain the children's long-term exercising behavior.

Many studies have been conducted on improving the motivation of children and adults to participate in collective physical activity. Some studies, for example the mobile fitness applications such as BunnyBolt [3], have embedded a playful experience to increase motivation. However, these designs failed to consider co-located participation. Studies on tangible play objects, such as Swinxsbee [4] have focused on stimulating diverse social interaction patterns. Other studies have examined virtual reality solutions, such as Ripple [5] which has successfully created an immersive sports environment with unobtrusive feedback. However, such designs fail to show detailed information on user's progress. There is still room for research to address playful experiences with persuasion system targeting the enhancement of social engagement in collective physical activity.

In my research, I draw on theories relating to behavior change and playful experience. For instance, Self-determination Theory [6] explains children's willingness to participate in collective activity, the Susceptibility to Persuasion Scale (STPS) from Cialdini [7] provides the practical guidance to evaluate social influence. Furthermore, The Playful Experience (PLEX) Framework [8] contribute to assist design iterations.

Based on such theoretical work, I attempt to apply persuasive technology involving playful interactions to design an intervention for secondary school children at the aged 12 to 14. As a Ph.D. student with background in industrial design and digital media arts, I have done an exploratory study to examine how design solutions like a physical activity application can tackle the problem, in taking the requirements from the social environment into account. Which means these design solutions should not only aim for one child but also for teacher and peers. The research questions are:

1) How could playful interactions motivate children's participation in collective physical activity?
2) What are the effects of diverse social interaction patterns on the effectiveness of sustaining children's engagement in physical activity?
3) How could persuasive strategies play a role in designing playful interactions for diverse social patterns in the context of collective physical activity?

## Research Plan and Methodology

This project follows a research-through-design approach [9] to create a playful behavior change support system especially appealing for children. Firstly, the literature review in the areas of child development, human behavior model, social psychology, persuasive technology and game design is used to refine the research questions. Then, to answer these questions, several prototypes will be designed and evaluated in experiments in the target context with the target user groups.

I'm presently preparing a study and designing a playful shuttlecock using camera technology to capture children's unexpected and ludicrous movements in the process of

kicking Shuttlegrapher in a group (see fig1). Projection technology will also be integrated to create various game maps for each social pattern. Qualitative research methods such as observation and interview will be used to validate assumptions.

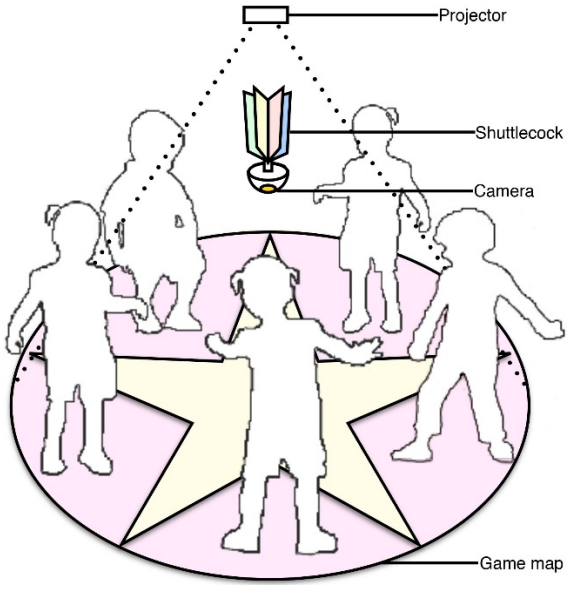


**Fig. 1.** Shuttlegrapher: a playful shuttlecock with projected game map

## Expected Contributions

The main contribution lies in making persuasive strategies playful and adaptable to diverse social patterns in collective physical activity of children. Specific outputs would be: 1) A playful behavior change support system that enhances the effectiveness of engagement in collective physical activity. 2) A playful persuasion model for the diverse social patterns in collective physical activity. 3) A model for evaluating the effectiveness of playfulness, social engagement and adaptability.

## References

1 Humphrey JH (2003) Child development through sports. Haworth Press, New York.
2. Roberts, G. C. (2001). Advances in Motivation in Sport and Exercise. Human Kinetics Publishers.
3. Keung, C., Lee, A., Lu, S., and O'Keefe, M. BunnyBolt: A mobile fitness app for youth. In Proc. of the 12th Int. Conf. Interaction Design and Children (2013), IDC '13, ACM, pp. 585–588.
4. Jansen M, Bekker T. (2009) Swinxsbee: a shared interactive play object to stimulate children's social play behaviour and physical exercise. In proc. of Intelligent Technologies for Interactive Entertainment Third International Conference. Amsterdam: Springer Berlin Heidelberg, pp. 90–101.
5. Lin X., Tao L., Yu B., Guo Y., Hu J. (2015) Interact Through Your Data: Collective Immersive Experience Design for Indoor Exercises. In: Rau P. (eds) Cross-Cultural Design Applications in Mobile Interaction, Education, Health, Transport and Cultural Heritage. CCD 2015. Lecture Notes in Computer Science, vol 9181. Springer, Cham.
6. Standage, M.,Duda, J. L., & Ntoumanis, N.(2003). A model of contextual motivation in physical education: Using constructs from self-determination and achievement goal theories to predict physical activity intentions. Journal of Educational Psychology, 95(1), 97-110.
7. Robert B Cialdini. Harnessing the science of persuasion, volume 79. 2001.
8. Arrasvuori, J., Boberg, M., Holopainen, J., Korhonen, H., Lucero, A., and Montola, M. Applying the PLEX framework in designing for playfulness. In Proc. of DPPI'11. ACM Press.
9. John Zimmerman, Jodi Forlizzi, Shelley Evenson, Research Through Design as a Method for Interaction Design Research in HCI, CHI 2007, April 28–May 3, 2007, San Jose, California, USA.

# Exploring Patients' and Counsellors' User Experiences of a Blended Smoking Cessation Treatment

Lutz Siemer

Saxion University of Applied Sciences, Research group Technology, Health & Care, Enschede, The Netherlands
✉ l.siemer@saxion.nl

## Background

Blended treatment - an integration of web-based and face-to-face treatment - is expected to combine the "best of both worlds" [1] as this allows the strengths of one to offset the weaknesses inherent in another [2]. Whilst ongoing randomized controlled trials examined the (cost-)effectiveness of blended treatment in e.g. cognitive behavioral therapy for major depression [3, 4] or smoking cessation counselling [5], little is known about the user experiences (UX) of a blended treatment [6]. However, UX plays an important role in the persuasiveness of a treatment [7]. UX has shown to explain user behavior [8], which in turn affects treatment efficiency [9]. To the best of our knowledge there is no detailed description of the UX in a blended smoking cessation treatment (BSCT) delivered as routine care.

## Purpose

This study aims to describe the UX of both counsellors and patients with BSCT by exploring (1) positive/negative user experience, (2) expectations at the start of BSCT, (3) motivations to adhere to BSCT, (4) active ingredients of BSCT, (5) moods during BSCT, (6) advantages and disadvantages, and (7) contextual factors such as the patients' health, social influence, technology used for the web-based sessions, and the places where treatment took place (clinic, home, work, on the road).

## Method

Semi-structured interviews were conducted with ten BSCT patients and three BSCT counsellors of the outpatient smoking cessation clinic of Medisch Spektrum Twente hospital in Enschede, The Netherlands. The interviews were audio-recorded and subsequently transcribed. We are currently working on data analysis, in which we use an abductive reasoning approach [10] with the aim of understanding and interpreting the UX of BSCT by applying deductive content analysis [11]. Following Morrow's recommendations to make use of multiple data sources [12] the analysis will also include additional information from (1) the patient's medical record, (2) the patient's online record of the web-based treatment platform www.rokendebaas.nl; and (3) online questionnaires already filled in by the patient for a concurrent study on treatment efficacy [5].

## Expected findings

The study is expected to offer insight in pros and cons of BSCT, influencing factors for user behavior (adherence), subgroups of patients for whom BSCT might have a better fit (matching), and critical interactions between both modes of delivery (face-to-face and web-based). Based on the ongoing analysis of the interviews and additional resources it seems that the UX exploration may – in the long term - lead to the description of (user) personae which represent the goals and behaviors of a hypothesized group of blended treatment users. These personae may ultimately be used for redesign of BSCT and to improve matching between counselors, patients and treatment [13].

## Originality/value

Blended treatment is a new approach to eHealth in which many aspects are still not known. This study will extend the insight into aspects such as UX and persuasiveness by exploring the interdependences of the two actors (patient and counselor) and the two modes of delivery (face-to-face/synchronous and web-based/asynchronous) and how these interdependences

influence the treatment.

## Progress

The UX study started in autumn 2016 and is expected to be finished in summer 2017. Data collection occurred between 11/2016 and 02/2017, and analysis of the data is scheduled from 01/2017 to 03/2017. In April 2017, we expect to be in the finalizing phase, so that we will be able to present (preliminary) results at the doctoral consortium. The doctoral consortium will be a good opportunity to discuss these results before publication.

## References

1. van der Vaart, R., et al., Blending online therapy into regular face-to-face therapy for depression: content, ratio and preconditions according to patients and therapists using a Delphi study. BMC Psychiatry, 2014. 14(1): p. 355.
2. Barak, A., et al., A comprehensive review and a meta-analysis of the effectiveness of internet-based psychotherapeutic interventions. Journal of Technology in Human Services, 2008. 26(2-4): p. 109-160.
3. Kooistra, L.C., et al., Blended vs. face-to-face cognitive behavioural treatment for major depression in specialized mental health care: study protocol of a randomized controlled cost-effectiveness trial. BMC Psychiatry, 2014. 14(1): p. 290.
4. Romijn, G., et al., Cost-effectiveness of blended vs. face-to-face cognitive behavioural therapy for severe anxiety disorders: study protocol of a randomized controlled trial. BMC Psychiatry, 2015. 15(1): p. 311.
5. Siemer, L., et al., Study protocol for a non-inferiority trial of a blended smoking cessation treatment versus face-to-face treatment (LiveSmokefree-Study). BMC Public Health, 2016. 16(1): p. 1187.
6. Kooistra, L.C., et al., Development and initial evaluation of blended cognitive behavioural treatment for major depression in routine specialized mental health care. Internet Interventions, 2016. 4: p. 61-71.
7. Tromp, N., P. Hekkert, and P.-P. Verbeek, Design for socially responsible behavior: a classification of influence based on intended user experience. Design Issues, 2011. 27(3): p. 3-19.
8. Castaneda, J.A., F. Munoz-Leiva, and T. Luque, Web Acceptance Model (WAM): Moderating effects of user experience. Information & Management, 2007. 44(4): p. 384-396.
9. Richardson, A., et al., Engagement promotes abstinence in a web-based cessation intervention: cohort study. Journal of medical Internet research, 2013. 15(1): p. e14.
10. Dubois, A. and L.E. Gadde, Systematic combining: an abductive approach to case research. Journal of Business Research, 2002. 55(7): p. 553-560.
11. Elo, S. and H. Kyngas, The qualitative content analysis process. J Adv Nurs, 2008. 62(1): p. 107-15.
12. Morrow, S.L., Quality and trustworthiness in qualitative research in counseling psychology. Journal of Counseling Psychology, 2005. 52(2): p. 250-260.
13. Junior, P.T.A. and L.V.L. Filgueiras. User modeling with personas. in Proceedings of the 2005 Latin American conference on Human-computer interaction. 2005. ACM.

# Design and implementation of ICT-based communication systems for victim-offender mediation

Lisanne van den Berg

Psychology of Conflict, Risk, & Safety, University of Twente, The Netherlands
✉ l.i.s.a.vandenberg@utwente.nl

Crime is a major societal problem as it highly impacts individual's well-being and undermines society as a whole. This project's ambition is to realize ground-breaking advances in the effectiveness and applicability of victim-offender mediation (VOM), through the design and implementation of digital communication systems. VOM is often considered a crucial step in the psychological recovery of crime victims [1] as well as for the effective treatment and prevention of recidivism of offenders [2]. In contrast to the traditional handling of criminal cases in court without mediation, VOM offers both parties better means to deal with the offense at hand and to agree on suitable reparation arrangements [3]. As such, VOM is increasingly offered and implemented as a basic, self-reliant social service for victims and offenders in Europe and abroad [4].

Although VOM is considered societally beneficial in terms of increasing well-being, reparation settlements, and crime reduction, parties often decline the opportunity to meet face-to-face because they believe a direct confrontation will be too stressful. For this reason, most VOM programs also make use of *indirect* forms of contact, such as writing letters or shuttle mediation, in which the mediator communicates messages between parties. Studies show, however, that these indirect forms of mediation are far less effective than face-to-face meetings [5,6]. For example, after an evaluation of three VOM programs in England and Wales, Shapland [7] stipulated that “indirect mediation contains the potential for miscommunication which face-to-face meetings … tend to dispel” (p.34).

Recent technological developments have created the possibility for the use of direct, digital, multi-party communication systems in mediation. The use of such online systems of communication between victims, offenders and mediators may offer the best of both worlds: the possibility of direct, live communication without the high levels of stress associated with physical proximity between victims and offenders. Moreover, mediation through stable and secure online communication systems may provide a cost- and time-saving alternative to face-to-face meetings, for example in the case of distant parties or mediation with offenders in prison. However, it is unclear how such a system should be designed in order to meet the needs of the end-users and stakeholders, and in what way such a system may be able to assist end-users during a mediation session in order to make that process more effective. It is also unclear what the precise effects of such digital systems of communication are, including what risks are associated with the use of such systems in the emotionally charged domain of VOM.

## Central research question and project goals

In order to answer these questions, the following research question and goals have been formulated:

***Central research question:*** To what extent are digital communication systems effective in facilitating reparation settlements, emotional recovery and reduced crime risks among victims and offenders?

***Project goals:*** The following project goals have been formulated in relation to the central research question:

1. To design multi-party, digital, text interaction and video conferencing communication systems which fit the requirements for VOM (e.g. system stability, privacy, user rights)

2. To model the system-related as well as psychological risks associated with the use of these communication systems in practice prior to implementation (and adjust/optimize systems)

3. To implement and evaluate the effectiveness of optimally developed digital communication systems among victims and offenders in the field of VOM

**Research approach**

Given that no previous digital communication systems have been developed in the VOM field, one key issue is what such a system should look like in terms of functionality and interface. What needs, tasks, and goals to mediators, victims and offenders currently have, and in what way would a system be able to support those needs, tasks and goals? How should future use of a system differentiate for mediators, victims, and offenders? In order to answer these and related questions, the research project will adopt a user-centered design approach. That is, end-users will be included in every step of the design process in order to verify its usability [8].

First, end-users and stakeholders will be identified and further inquiry will take place in order to get a comprehensive overview of their psychological needs, tasks, and goals in relation to the future system. These findings then will be used to make an informed decision about the development and interface design of the system [9]. Involving the end-users so thoroughly in the design process helps create a system that will be easy to navigate and interact with [8]. This is of particular importance for a system that will be used in VOM, because victims and offenders will only make use of the system once, typically in an emotionally charged setting. Currently, the project is still in the first phase i.e. collecting user data in order to get a complete picture. Part of this phase is a review of the literature, in order to uncover the factors that promote or hinder the effectiveness of victim-offender mediation and synchronous computer-mediated communication in conflictual interactions.

Apart from reviewing existing scientific evidence, two empirical studies have been set up in order to collect more information on the psychological needs, tasks, and goals of the end-users of the system (i.e. user research). The first user research study concerns interviews with the three end-user groups: mediators, victims, and offenders. These interviews will be divided into three parts: the interviewee's experience of VOM, their experience with digital applications, and their vision of the use of digital communication systems during VOM. Participants will be selected through non-probability sampling, and the number of participants selected currently is around 5 to 8 in each end-user group. At the time of the doctoral consortium, findings from these interviews will be presented.

Also, a survey will be distributed amongst mediators, victims, and offenders. This survey will be based on the Technology Acceptance Model (TAM). This model seeks to explain the *actual usage* of a technology. The key explanatory variable is *intention to use,* which in turn is explained by *perceived usefulness* (i.e. the extent to which one believes a given technology is able to assist him with a given task) of a technology and the *perceived ease of use* [10]. Over the years the model has been extended (TAM2 and TAM3) and applied in different domains such as health care information systems, search engines and mobile internet-acceptance [11]. The survey findings will be used to further develop and add to the user

profiles. Results from the survey will also be shared at the doctoral consortium.

Findings from the review and user studies will be collected in user profiles and will be continually updated. These user profiles can be used to develop personas and form the backbone of the initial system requirements list. These initial system requirements will then be subjected to advanced risk analysis using fault trees [12]. This risk analysis will result in a rank ordered list of system requirements in terms of their importance for an effective communication process during VOM. Based on this list of requirements, one or more prototypes will be developed, which are subsequently (user and usability) tested and optimized.

In the final stage of the project, these optimally developed communication systems are integrated into the mediation services offered by "Slachtoffer in Beeld" [Victim in Focus]. This government-funded organization sets up voluntary meetings and indirect mediation between victims and offenders under supervision of professional mediators. The impact on victims and offenders who participate in existing and new forms of mediation, as well as those of victims and offenders who refused participation, are assessed through standardized measurements. This allows for a comparison between the effects of the new, digital and existing VOM forms. Through this approach, the feasibility and effectiveness of digital communication technology in the domain of victim-offender mediation is examined.

## References

1. Strang, H., Sherman, L., Angel, C. M., Woods, D. J., Bennett, S., Newbury-Birch, D., & Inkpen, N. (2006). Victim evaluations of face-to-face restorative justice conferences: A quasi-experimental analysis. *Journal of Social Issues, 62*, 281-306.
2. Sherman, L., Strang, H., Mayo-Wilson, E., Woods, D. J., & Ariel, B. (2015). Are restorative justice conferences effective in reducing repeat offending? Findings from a Campbell Systematic Review. *Journal of Quantitative Criminology, 31*, 1-24.
3. Daly, K. (2004). *A tale of two studies: Restorative justice from a victim's perspective.* In E. Elliot & R. Gordon (Eds.), Restorative justice: Emerging issues in practice and evaluation. Cullompton, UK: Willan.
4. Ezendam, H. & Wheldon, F. (2014). Recognition of victims' rights through EU Action: latest developments and challenges. In: I. Vanfraechem, A. Pemberton and F. N. Ndahinda (Eds). International Handbook of Victimology. London: Routledge.
5. Umbreit, M. S., Coates, R. B., & Vos, B. (2004). Victim-offender mediation: Three decades of practice and research. *Conflict Resolution Quarterly, 22*, 279-303.
6. Zebel, S. (2012). Een quasi-experimentele studie naar de effecten van de Nederlandse slachtoffer-dadergesprekken [A quasi-experimental study into the effects of the Dutch victim-offender meetings]. In I. Weijers (Ed.), Bemiddeling na strafbare feiten: De Nederlandse slachtoffer-dadergesprekken [Mediation after punishable offences: The Dutch victim-offender meetings (pp. 21-44). The Hague, The Netherlands: Boom Juridische uitgevers.
7. Shapland, J., Atkinson, A., Atkinson, H., Chapman, B., Dignan, J., Howes, M., Johnstone, J., Robinson, G., & Sorsby, A. (2007). Restorative justice: The views of victims and offenders. London: Ministry of Justice Research Series 3/07.
8. Maguire, M. (2001). Methods to support human-centered design. *International Journal of Human Computer Studies, 55*, 587-634.
9. Van Velsen, L., Wentzel, J. & Van Gemert-Pijnen, J. E. W. C. (2013). Designing eHealth that matters via a multidisciplinary requirements development approach. *JMIR research protocols.* Doi: 10.2196/resprot.2547
10. Venkatesh, V. & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46*(2), 186–204. Doi:10.1287/mnsc.46.2.186.11926
11. Marangunic, N. & Granic, A. (2015). Technology acceptance model: a literature review from 1986 to 2013. *Universal Access in the Information Society, 14*, 81-95.
12. Arnold, F., Hermans, H., Pulungan, R. & Stoelinga, M. (2014). Time-dependent analysis of attacks. In M. Abadi and S. Kremer (Eds.), *POST 2014, LNCS 8414.* (pp. 285-305).

# Tutorials

## Tutorial Chairs

Jaap Ham Eindhoven University of Technology, The Netherlands
Cees Midden Eindhoven University of Technology, The Netherlands
Luciano Gamberini University of Padua, Italy

# Choice Support as a Component of Persuasive Technology

Anthony Jameson

DFKI, German Research Center for Artificial Intelligence, Germany
✉ jameson@dfki.de

This proposed half-day tutorial offers researchers, practitioners, and students in the persuasive technology field a deep understanding of a theme introduced in my keynote talk ([3]) at the 2013 Persuasive Technology conference in Sydney: People in the persuasive technology field should be able not only to use technology to *persuade* people to do particular things but also to help people *choose for themselves*. The tutorial will clarify this distinction, motivate the central claim, and introduce the participants to the scientific knowledge and thought patterns that they need in order to be able to combine persuasion with choice support.

## Persuasion vs. Choice Support

With *persuasion*, people are encouraged via any of a variety of means to choose particular behaviors or attitudes that are known in advance to the persuading agent. An agent that offers *choice support* is likewise attempting to influence a person's choices, but not in a particular predetermined direction. Instead, the choice support agent aims to help a person make a choice that is likely to work well for him or her, whatever particular option the person may end up choosing. Consider as an example the difference between (a) persuading someone to exercise more and (b) helping someone to figure out what particular forms of exercise he or she finds most rewarding. As this example shows, persuasion and choice support can often be naturally and effectively combined: Helping someone to find a form of exercise that works well for them can be an effective part of an effort to persuade him or her to get more exercise. Conversely, helping people to choose effectively for themselves can involve things like persuading them to apply effective procedures for making a choice.

More generally, strategies for persuasion can be systematically transformed into strategies for choice support through application of a few general principles. And in the other direction, strategies for choice support can usually be applied in a (more or less subtly) biased way that turns them into strategies for persuasion.

[3] summarized the relationship by saying that persuasion and choice support are like the black and white keys of a piano: You can play nice melodies on the white keys or on the black keys, but you can play more effectively if you use all of the keys.

## Why This Tutorial Is Needed

Traditionally, the fields of persuasion and choice support have unfortunately been largely disjoint. Only a rather small fraction of the scientific research and literature taken into account by the one field is also taken into account by the other. This failure to see the big picture represents a big missed opportunity for both fields. One practical reason why it is not been easy for persuasive technology researchers and practitioners to make use of research relevant to human choice and choice support is the simple fact that the relevant research is vast, complicated, and in many ways confusing. It includes a variety of perspectives that at first glance seem mutually incompatible and whose research literatures are largely disjoint.

## An Integrative Conception of Choice Architecture

In an effort to overcome this practical problem, I have spent much of the past eight years working out a usable synthesis of research on human choice and choice support that is suitable for understanding and application by those who are engaged in research or practice on interactive computing technology—including, of course, people in the persuasive technology field. The wide range of perspectives on how people make choices in everyday life are combined into the integrated ASPECT model, which distinguishes six *choice patterns*

that people use alternately or in combination. Similarly, the wide spectrum of ways in which it is possible to support people when they make choices are synthesized in terms of the ARCADE choice support strategies, which can likewise be used by people or systems alternately or together. This combination of the ASPECT and ARCADE models yields a general way of approaching problems of choice support: Consider which of the six ASPECT choice patterns people might be applying in the situation in which you are trying to help them make better choices; and anticipate specific difficulties that can arise in applying these choice patterns in this situation. Then consider which of the ARCADE choice support strategies can be applied to overcome these difficulties. This analytical method regularly generates new ideas about how to help people make better choices. These ideas need to be tested and adapted in particular application situations, but their grounding in theoretical and empirical research creates good conditions for this practical application.
This perspective has been expounded in detail in the book-length monograph *Choice Architecture for Human-Computer Interaction* ([4]) and it has been applied in recent handbook chapters to the domains of recommender systems ([8]) and multimodal systems ([6]), respectively.

**Content of the Proposed Tutorial**
The proposed tutorial will show participants how to exploit this perspective within the persuasive technology field.
Specifically, for each of the six ASPECT choice patterns, one or more examples relevant to the persuasive technology field will be considered (e.g., the abovementioned problem of helping people to choose a form of exercise that works well for them). We will then discuss how ARCADE choice support strategies can be applied to the choice pattern in question; whether and how the same choice support ideas can be adapted for persuasive purposes; and how persuasive techniques can contribute to the choice support.
Participants will be encouraged to contribute actively to discussion of the examples on the basis of their own experience—a procedure that I have used extensively in my previous tutorials (see below). After the tutorial, participants will be able to deepen their knowledge to any extent that they like by consulting the monograph *Choice Architecture for Human-Computer Interaction* and optionally by pursuing the primary references cited in that work.

**Qualifications of the Presenter**
As can be seen from my web homepage[1] I have almost four decades of experience in research on interactive intelligent systems, and I have often presented influential theoretical syntheses like the one offered in this tutorial, including ones in the areas of systems that adapt to their users ([2], [5]); group recommender systems ([7]); and ubiquitous computing ([1]). My experience as founding coeditor-in-chief of the *ACM Transactions on Interactive Intelligent Systems* from 2009–2016 has helped to ensure a broad understanding of relevant systems. In parallel, I have been engaged in extensive practical work directing research and development projects and consulting for industry. For example, since 2014 I have directed a multinational, multi-million euro project which produced technology that won the 2015 SemanticWeb Challenge and is currently being commercialized.
I also have extensive experience in teaching tutorials like the one offered here. For examplemy last three tutorials in the CHI conference series, which were related to the topic offered here, received consistently above-average evaluations, and the tutorial material was used in 2013 by the tutorial organizers as a positive example for other CHI tutorial presenters. If the proposed tutorial is accepted for Persuasive Technology 2017, I will create similarly high-quality tutorial materials and advertise the tutorial via relevant mailing lists, thereby helping to attract participants to Persuasive Technology 2017.

[1] http://dfki.de/ jameson/

As with my previous conference tutorials[2] there will be a public web page for potential tutorial participants that will include (a) a brief tutorial description, (b) a link to this 4-page tutorial description, and (c) a link to the book-length monograph *Choice Architecture for Human-Computer Interaction* ([4]), which has been made publicly available by arrangement with the publisher.[3]

## References

1. Jameson. Modeling both the context and the user. *Personal and Ubiquitous Computing*, 5(1):29–33, 2001.
2. Jameson. Adaptive interfaces and agents. In A. Sears and J. Jacko, editors, *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*, pages 433–458. CRC Press, Boca Raton, FL, 2nd edition edition, 2008.
3. Jameson. How can persuasive technology help people choose for themselves? In S. Berkovsky and J. Freyne, editors, *Proceedings of Persuasive 2013*. Springer, Berlin, 2013. Abstract of a keynote address.
4. Jameson, B. Berendt, S. Gabrielli, C. Gena, F. Cena, F. Vernero, and K. Reinecke. Choice architecture for human-computer interaction. *Foundations and Trends in Human-Computer Interaction*, 7(1–2):1–235, 2014.
5. Jameson and K. Gajos. Systems that adapt to their users. In J. Jacko, editor, *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*. CRC Press, Boca Raton, FL, 3rd edition edition, 2012.
6. Jameson and P. O. Kristensson. Understanding and supporting modality choices. In S. Oviatt, B. Schuller, P. Cohen, and D. Sonntag, editors, *Handbook of Multimodal-Multisensor Interfaces*. Morgan & Claypool, Williston, VT, U.S.A., 2017. In press.
7. Jameson and B. Smyth. Recommendation to groups. In P. Brusilovsky, A. Kobsa, and W. Nejdl, editors, *The Adaptive Web: Methods and Strategies of Web Personalization*, pages 596–627. Springer, Berlin, 2007.
8. Jameson, M. Willemsen, A. Felfernig, M. de Gemmis, P. Lops, G. Semeraro, and L. Chen. Human decision making and recommender systems. In F. Ricci, L. Rokach, and B. Shapira, editors, *Recommender Systems Handbook*. Springer, Berlin, 2nd edition edition, 2015.

[2] See, for example, http://www.dfki.de/ jameson/chi13-course-jameson/
[3] http://dfki.de/ jameson/abs/JamesonBG+14.html

# Persuasive Systems Design, Evaluation and Research with the PSD Model

Harri Oinas-Kukkonen

University of Oulu, Faculty of Information Technology and Electrical Engineering
Paavo Havaksen tie 3, FIN-90570 Oulu, Finland
✉ harri.oinas-kukkonen@oulu.fi

## Tutorial description

Deep understanding of user behavior has become a key for successful design in our contemporary IT environments [1]. A growing number of information technology systems and services are being developed to change users' attitudes or behavior or both. Despite the fact that attitudinal theories from social psychology have been quite extensively applied to the study of user intentions and behavior, these theories have been developed, for instance, for predicting user acceptance of the information technology rather than providing systematic analysis and design methods for developing persuasive software solutions.

This tutorial will introduce a conceptual framework for designing and evaluating persuasive systems, known as the Persuasive Systems Design (PSD) model [2]. The PSD describes the process of designing and evaluating persuasive systems and describes what kind of software functionality may be found in the final product. It also highlights underlying assumptions behind any persuasive system and ways to analyze contexts for persuasion. The PSD model helps select and design the persuasive features, and categorizes them into primary task, computer-human dialogue, system credibility, and social influence. This tutorial will also present research results from a wide variety of PSD related projects.

The PSD model can be applied for developing both full-fledged behavior change support systems [3, 4] and somewhat lighter persuasive applications [cf. 5, 6]. Areas such as fostering health [7], promoting sustainable/green behaviors [8], and perhaps also e-selling [9] can benefit from these approaches greatly. The topics addressed in this tutorial are expected to play a central role for advancing future IT design related business and economy.**Speaker bio**
Harri Oinas-Kukkonen, PhD, is Professor of information systems in the University of Oulu, Finland. His main research interests are behavior change, persuasive systems design, social influence, innovation creation and the next generation of the web. His research has been published in major scientific computer science and other journals.

**Keywords**: Behavior change; Persuasive technology; Persuasive systems design.

## Speaker bio

**Harri Oinas-Kukkonen**, PhD, is Professor of information systems in the University of Oulu, Finland. His main research interests are behavior change, persuasive systems design, social influence, innovation creation and the next generation of the web. His research has been published in major scientific computer science and other journals.

## References

1. Oinas-Kukkonen Harri & Oinas-Kukkonen Henry (2013) Humanizing the Web: Change and Social Innovation. Palgrave Macmillan, Basingstoke, UK.
2. Oinas-Kukkonen Harri & Harjumaa Marja (2009) Persuasive Systems Design: Key Issues, Process Model, and System Features. Communications of the Association for Information Systems, Vol. 24, Article 28, pp. 485-500, March 2009.
3. Oinas-Kukkonen Harri (2013) A foundation for the study of behavior change support systems. Personal and ubiquitous computing, Vol. 17, No. 6, August 2013, pp. 1223-1235.
4. Lehto Tuomas & Oinas-Kukkonen Harri (2015) Explaining and Predicting Perceived Effectiveness and Use Continuance Intention of a Behavior Change Support System. Behaviour and Information Technology, doi:10.1080/0144929X.2013.866162.

5. Ploderer Bernd, Reitberger Wolfgang, Oinas-Kukkonen Harri & van Gemert-Pijnen Julie (2014) Social interaction and reflection for behaviour change. Personal and ubiquitous computing, Vol. 18, No. 7, October 2014, pp. 1667-1676, doi: 10.1007/s00779-014-0779-y.
6. Oduor Michael, Alahäivälä Tuomas & Oinas-Kukkonen Harri (2014) Persuasive software design patterns for social influence. Personal and ubiquitous computing, Vol. 18, No. 7, October 2014, pp. 1689-1704, doi: 10.1007/s00779-014-0779-y.
7. Kelders SM, Kok RN, Ossebaard HC, Van Gemert-Pijnen JEWC. (2012). Persuasive System Design Does Matter: A Systematic Review of Adherence to Web-based Interventions, Journal of Medical Internet Research (14:6), e152.
8. Corbett, Jacqueline (2013) Designing and Using Carbon Management Systems to Promote Ecologically Responsible Behaviors, Journal of the Association for Information Systems: Vol. 14, Issue 7, Article 2.
9. Parvinen Petri, Oinas-Kukkonen Harri & Kaptein Maurits (forthcoming). ESelling: A New Avenue of Research for Service Design and Online Engagement. Electronic Commerce Research and Applications

# Demos

**Demo Chair**
Thomas Van Rompay University of Twente, The Netherlands

# mHealth application “Stopmaatje”: persuasive technology for smoking cessation

Somaya Ben Allouch[1], Leon Chevalking[1], Marloes Postel[2], M. Brusse-Keizer[3], & Marcel Pieters[4]

[1]Saxion University of Applied Sciences, Enschede, The Netherlands
[2]Tactus Addiction Care, Enschede, The Netherlands
[3]Medisch Spectrum Twent, Enschede, The Netherlands
[4]University of Twente, Enschede, The Netherlands
✉ s.benallouch@saxion.nl

## Description and purpose of the system

Smoking is a serious health problem. WHO estimates that over 1 billion people worldwide smoke tobacco and the deaths of 6 million people per year can be attributed to causes of smoking (Bilano et al., 2015). There are several smartphone apps for smoking cessation available for a broad audience, however most of them have general content which is not based on scientific results and do not have a tailored-approach meeting individual needs, while both can have a positive effect on cessation (Abroms et al., 2011; Hoeppner et al., 2015). Only a few recent studies account for these shortcomings by developing cessation apps in a scientific context, with validated and tailor-made content such as SmokeFree 28 (Ubhi et al., 2015), DistractMe (Ploderer et al., 2014), Crush the Crave (Baskerville et al., 2015), SmartQuit (Bricker et al., 2014), QuitGuide (Bricker et al., 2014) and REQ-Mobile (Buller et al., 2014). Although the use of these cessation apps is scientifically evaluated involving end-users, the design and development process of these apps is mostly done without any stakeholder involvement during the development process.

## Status of implementation

Our mobile smoking cessation application is developed following the CeHReS roadmap (van Gemert-Pijnen et al., 2011). The process of the development of the mHealth application is currently at the end of the design phase. The first three steps of the roadmap are successfully followed. During the contextual inquiry seven stakeholders have expressed their view on the application and information was gathered on the intended users and the environments in which the cessation app will be implemented.

In the next step, information was gathered on routines from primary end-users (smokers, caregivers and practitioners). This type of data collection was done through multiple focus-groups consisting of thirty patients, caregivers and practitioners. In addition an online survey was conducted among a group of approximately 1000 (ex)smokers to get insights into an appropriate audience segmentation of the app. The results of the survey combined with the views expressed in the interviews and focus groups results were used to determine values, attributes and requirements for the persuasive technology.

In the value specification phase the results from the contextual inquiry were used to compose a first draft of the requirements document. The document was presented to five stakeholders and six primary end users during focus groups. In the focus groups respondents were invited to discuss the requirements to the extent they matched with their given input in the contextual inquiry. Additionally, respondents were invited to elicit more requirements.

During the design phase two focus groups were held and a questionnaire was conducted to gather feedback on the first design. Twenty stakeholders participated in the focus groups and over 200 respondents took part in the questionnaire. The data led to improvements in the design and usability of the mobile smoking cessation application.

Currently the application is going through the first step of the operationalization phase which consists of a real-life test environment. Twelve (ex)smokers have been asked to use the application in their real life environment for six weeks. This phase ends by the end of January after which the log data will reveal patterns of use that can help to improve the user experience of the application. Also after this test phase users will be asked about the level of persuasiveness of the mobile app.

**Contents of the demo**

During focus groups in the contextual inquiry phase, respondents were asked to come up with their own ideas about content of their ideal smoking cessation app and were asked whether content from the six scientifically developed apps: SmokeFree 28, DistractMe, Crush the Crave, SmartQuit, QuiteGuide, and REQ-mobile would interest them. This resulted in the following content of our mobile smoking cessation application, which will all be demonstrated during the session at Persuasive2017: Tips and advice on cessation; General health information and benefits; Chat; Distraction; Support button; Planning and monitoring, and Diary.

**References**

Abroms, L. C., Padmanabhan, N., Thaweethai, L., & Phillips, T. (2011). iPhone Apps for Smoking Cessation A Content Analysis. American Journal of Preventive Medicine, 40(3), 279-285. doi:10.1016/j.amepre.2010.10.032

Baskerville, N. B., Struik, L. L., Hammond, D., Guindon, G. E., Norman, C. D., Whittaker, R., . . . Brown, K. S. (2015). Effect of a mobile phone intervention on quitting smoking in a young adult population of smokers: randomized controlled trial study protocol. JMIR Res Protoc, 4(1), e10. doi:10.2196/resprot.3823

Bilano, V., Gilmour, S., Moffiet, T., d'Espaignet, E. T., Stevens, G. A., Commar, A., . . . Shibuya, K. (2015). Global trends and projections for tobacco use, 1990-2025: an analysis of smoking indicators from the WHO Comprehensive Information Systems for Tobacco Control. Lancet, 385(9972), 966-976.

Bricker, J. B., Mull, K. E., Kientz, J. A., Vilardaga, R., Mercer, L. D., Akioka, K. J., & Heffner, J. L. (2014). Randomized, controlled pilot trial of a smartphone app for smoking cessation using acceptance and commitment therapy. Drug Alcohol Depend, 143, 87-94. doi:10.1016/j.drugalcdep.2014.07.006

Buller, D. B., Borland, R., Bettinghaus, E. P., Shane, J. H., & Zimmerman, D. E. (2014). Randomized Trial of a Smartphone Mobile Application Compared to Text Messaging to Support Smoking Cessation. Telemedicine and E-Health, 20(3), 206-214. doi:10.1089/tmj.2013.0169

Heffner, J. L., Vilardaga, R., Mercer, L. D., Kientz, J. A., & Bricker, J. B. (2015). Feature-level analysis of a novel smartphone application for smoking cessation. Am J Drug Alcohol Abuse, 41(1), 68-73. doi:10.3109/00952990.2014.977486

Hoeppner, B. B., Hoeppner, S. S., Seaboyer, L., Schick, M. R., Wu, G. W. Y., Bergman, B.
G., & Kelly, J. F. (2015). How Smart are Smartphone Apps for Smoking Cessation?
A Content Analysis. Nicotine & Tobacco Research. doi:10.1093/ntr/ntv117

LeRouge, C., Ma, J., Sneha, S., & Tolle, K. (2013). User profiles and personas in the design and development of consumer health technologies. International Journal of Medical Informatics, 82(11), E251-E268. doi:10.1016/j.ijmedinf.2011.03.006

Ploderer, B., Smith, W., Pearce, J., & Borland, R. (2014). A mobile app offering distractions and tips to cope with cigarette craving: a qualitative study. JMIR Mhealth Uhealth, 2(2), e23. doi:10.2196/mhealth.3209

Ubhi, H. K., Michie, S., Kotz, D., Wong, W. C., & West, R. (2015). A mobile app to aid smoking cessation: preliminary evaluation of SmokeFree28. Journal of Medical Internet Research, 17(1), e17. doi:10.2196/jmir.3479

van Gemert-Pijnen, J. E. W. C., Nijland, N., van Limburg, M., Ossebaard, H. C., Kelders, S. M., Eysenbach, G., & Seydel, E. R. (2011). A Holistic Framework to Improve the Uptake and Impact of eHealth Technologies. Journal of Medical Internet Research, 13(4). doi:ARTN e111 10.2196/jmir.1672

# Question system for memory recollection. A virtual agent assisting PTSD patients during exposure therapy

Myrthe Tielman[1], Mark Neerincx[1,2], & Willem-Paul Brinkman[1]

[1]Delft University of Technology, The Netherlands
[2]TNO, The Netherlands
✉ m.l.tielman@tudelft.nl

## Background

Post-Traumatic Stress Disorder (PTSD) is a mental disorder following one or more traumatic experiences [1]. PTSD is most commonly treated with cognitive behavioral therapy (CBT) with exposure [2]. This means that patients need to recollect their memories in detail during therapy. However, this process is very difficult. One of the key characteristics of PTSD patients is that they actively avoid thinking about their trauma. During therapy, they have to break this pattern of behavior.

Within the VESP project the aim is to develop and evaluate a stand-alone computer-based home therapy system for PTSD. This system is named the Multi-Model Memory Restructuring (3MR) system. Within the 3MR system patients follow therapy guided by a virtual agent. The memories can be described in a digital diary and recreated in a virtual environment. In order to successfully finish this therapy, patients need to describe their memory in detail in the diary. However, doing this without assistance is very difficult as traumatic memories are often disorganized and fragmented in PTSD patients [3]. According the FBM model of behavior, people will display a behavior if they are motivated, able and receive a trigger [4]. As ability is a problem when PTSD patients need to recollect their memories, the virtual agent included in the therapy assists them with this task. By asking structured, personalized and detailed questions about the traumatic memory, patients are guided through the exposure sessions. These structured questions increase the ability of the patient to describe their memory, while the personalization triggers them to think back to specific details. The questions are posed by a virtual agent and generated by an ontology-based question system for memories.

## 3MR System

The ontology-based question system is a component of the 3MR system. The 3MR system offers a full therapy to patients, while the ontology system focuses on posing relevant questions. These questions are offered by a virtual agent in a digital diary. Patients can add textual answers to the diary, but also maps, images, media and emotion words. A screenshot of a diary page after questions are answered is shown in Figure 1.

The ontology-based question system is organized around the topics of location, objects, people, actions, senses and emotions. Two different versions of the system exist, one specializing in veterans, the other in childhood sexual abuse. The ontology contains relevant classes for each topic. For example, the location class in the veteran version contains names of specific locations in Afghanistan or Serbia (among others), based on deployment of the patient. Per topic, the first questions will be multiple-choice and aimed at getting more knowledge about this topic. For instance, the first question for location will be In what type of location were you during your memory? Once this has been established, more detailed open questions will be posed based on the earlier answer. For example, if the answer would be in a house, questions will be posed about who lived in the house, while in the forest will be followed by a question about the type of trees. These open questions correspond to the properties of the classes in the ontology. In this way, all topics will be treated. Through asking

these very detailed and structured questions, patients are invited to think back carefully. An experiment with non-patients about holiday memories showed that with such a system people describe their memories in more detail than when given a simple list of questions [5].

Figure 1. Screenshot of the diary and virtual coach. The items contain the answers to the questions, be it visual or textual. This image is translated, the original system is in Dutch.

**Demo**

During this demo, visitors will be able to either use the system themselves for a short while, or watch a video clip of the system in use. The live demo will be in Dutch only, but the authors will be able to translate for foreign researchers. The video clip of the system in use will be a comprehensive overview of the workings of the system. This video clip will be fully subtitled in English.

**Bibliography**

1. American Psychological Association, Diagnostic and Statistical Manual of Nental Disorders, Fifth Edition, American Psychiatric Association, 2013.
2. D. A. Clark and A. T. Beck, Cognitive Therapy of Anxiety Disorders, The Guilford Press, 2010.
3. M. Schauer, F. Neuner and T. Elbert, Narrative Exposure Therapy, Hogrefe, 2011.
4. B. Fogg, "A behavior model for persuasive design," in Proceedings of the 4th International Conference on Persuasive Technology, 2009.
5. M. L. Tielman, M. van Meggelen, M. A. Neerincx and W.-P. Brinkman, "An Ontology-based Question System for a Virtual Coach Assisting in Trauma Recollection," in Int. Conf. on Intelligent Virtual Agents, 2015.

# Twente TEACH, telemonitoring & coaching in stable chronic heart failure

Robin Wesselink[1] , Floor Sieverink[1], Liseth Tjin-Kam-Jet – Siemons[1], Andy Swiebel[2], Guido Plaggenborg[3], Salah Said[4], Gerard Linssen[5], & Lisette van Gemert-Pijnen[1]

[1]Centre for eHealth and Wellbeing Research, University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands
[2]Thales, Bestevaer 46, 1271 ZA Huizen, The Netherlands
3Vodafone Global Enterprise, Simon Carmiggeltstraat 6, 1011 DJ Amsterdam, The Netherlands
[4]Ziekenhuisgroep Twente, P.O. Box 546, 7550 AM Hengelo, The Netherlands
[5]Ziekenhuisgroep Twente, P.O. Box 7600, 7600 SZ Almelo, The Netherlands
✉ f.sieverink@utwente.nl

**Abstract for eHealth demonstration**
Chronic congestive heart failure (CHF) is a common disorder, associated with high morbidity and mortality. Early diagnosis and treatment of exacerbations coupled with personalized disease management for the patient could lower the amount of (re-)hospitalizations. Patients can be empowered to self-manage their problems, using telemonitoring and persuasive coaching.

iMediSense is an eHealth technology for telemonitoring and coaching. Development and testing is being conducted by the 'Twente TEACH' Team, a novel collaboration between business (Thales, Vodafone and Menzis), science (University of Twente) and healthcare (Ziekenhuisgroep Twente). The system is now tested among patients with CHF and their caregivers in secondary care. However, the system can be used with sensors of choice and it therefore has the potential to be of added value for patients with other chronic diseases and in other care settings as well.
With iMediSense, the patient with CHF can monitor his health status via a digital scale and sphygmomanometer that are linked via Bluetooth to a mobile app. Data is sent to a secured server in the hospital network through the regular 3g/4g cellular network. The cardiologist and heart failure nurse have access to these data and can contact the patient (via a message service in the app) in case of abnormalities. The system enables healthcare providers to intervene quickly in case of an upcoming exacerbation or health deterioration. It thus has the potential to prevent re-hospitalization. But, most importantly, the system provides patients with insight into their health status and therefore supports the development of self-management skills.

A user-centered design is pursued to identify the system requirements from the point of view of the patient and the caregiver. Results from the first pilot-study addressing the use, usability and usefulness for practice are currently wrapped up. Twenty-five CHF patients used the iMediSense application for a period of 2 months. With the use of log-data we analysed the use of the system during this period for both patient and caregiver. In 91% of the total amount of 1572 sessions, a measurement was completed & sent to the hospital. In 5% of the sessions a measurement was started but not finished and in 2,4% of the sessions a message was sent by a patient. A mean of 1 alarm per day per user (patient) was generated.

In order to support self-management, the system needs to be more than only a portal that exchanges data from patient to caregiver. With the current experience and first lessons learned, the outline of a persuasive coaching module for both caregiver and patient can be

designed. For example, smarter algorithms should reduce the amount of unnecessary alarms that put a serious burden on the caregivers. For the patients, this technology should adapt to the use and preferences of the individual user, requesting and providing information or feedback at the right time, tailored to the needs of the individual patient.
From the point of view of the caregiver, the organization of healthcare has to be adapted to this new way of providing care to these patients. Some care processes can potentially be substituted in the short term, but introduction of this technology supported by structural changes in organization could potentially improve the effectiveness of this technique, the quality of care and the workload in hospitals.

# Workshop Proposals

## Workshop Chairs


| | |
|---|---|
| Saskia Kelders | University of Twente, The Netherlands |
| Geke Ludden | University of Twente, The Netherlands |

## Workshop 1: Fifth International Workshop on Behavior Change Support Systems (BCSS 2017)

Programme Chairs: Piiastiina Tikka[1] & Randy Klaassen[2]
Organizing Chairs: Pasi Karppinen[1], Roelof de Vries[2], & Robby van Delden[2]
General Co-Chairs: Harri Oinas-Kukkonen[1], Lisette van Gemert-Pijnen[2], & Dirk Heylen[2]

[1]University of Oulu, Finland
[2]University of Twente, The Netherlands
✉ piiastiina.tikka@oulu.fi, r.klaassen@utwente.nl

This workshop aims at connecting multidisciplinary researchers, practitioners and experts from a variety of scientific domains, such as information sciences, psychology, human-computer interaction, industrial design and medicine. This interactive workshop will act as a forum where experts from multiple disciplines can present their work, and can discuss and debate the pillars for persuasive technology. Topics for submissions include the design & development and evaluation of behaviour change support systems. For more information see: https://bcssworkshop.wordpress.com/
This workshop is the result of the merger of two proposals, to be found below.

## Proposal 1a: Fifth International Workshop on Behavior Change Support Systems (BCSS 2017)

Piiastiina Tikka[1], Pasi Karppinen[1], Lisette van Gemert-Pijnen[2] and Harri Oinas-Kukkonen[1]

[1] Oulu Advanced Research on Service and Information Systems Group, Faculty of Information Technology and Electrical Engineering, University of Oulu, Oulu, Finland
[2] Psychology, Health & Technology, University of Twente, Enschede, The Netherlands

### Introduction

Our everyday life is impossible to imagine without modern technology. Humanizing technology is embedded in our daily environment, measuring our activities 24/7 via smart sensors, activity trackers, and various wearable devices [1,2]. Checking health status, tracking and managing our stocks, and controlling the temperature of our house via a mobile app has become a daily routine.

Persuasive technology reveals an interdisciplinary research and education area transcending the traditional use of technology as helpful to merely improve the accessibility, affordability, and efficiency of services within the institutional contexts. Technology has the capacity to create smart (virtual) persuasive environments that provide simultaneously multimodal cues and psycho-physiological feedback for personal change by strengthening emotional, social, and physical presence. Besides, smart environments collect and analyze sensor data by self-tracking behaviors, emotions, and thoughts; presenting a quantified holistic self-concept that will shed new lights on how technology integrates in our lives, and how people engage each other and their environments using unobtrusive and pervasive technologies. An array of persuasive applications has been developed over the past decade with an aim to induce desirable behavior change. Persuasive applications have shown promising results in motivating and supporting people to change or adopt new behaviors and attitudes, in various domains such as health and wellbeing, sustainable energy, education, and marketing.

This workshop aims at connecting multidisciplinary researchers, practitioners and experts from a variety of scientific domains, such as information sciences, psychology, human-computer interaction, industrial design and medicine. This interactive workshop will act as a forum where experts from multiple disciplines can present their work, and can discuss and debate the pillars for persuasive technology. Also, we like to introduce a new holistic concept: EPIC for Change.

In the next sections, we present our vision and discuss challenges, as well as new research directions within the field of engaging persuasive technologies and 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" [3].

**Background**

New technologies allow us to gather larger amounts of data from multiple sources, e.g., multi-sensor data and self-tracking data, that can be used for customization and personalization purposes. Where the focus was on small, exact datasets and causal connections in the past (i.e. knowing "why"); advances in big data cause a paradigm shift towards the gathering or linkage of large amounts of (noisy) data to demonstrate the presence of (unexpected) correlational connections (i.e. knowing "what") [4]. Though this opens new exciting frontiers of research, important concerns have been raised as well concerning issues like safety, profiling, purpose limitation, liability, data ownership, and (above all) privacy [4,5,6]. Such issues should be dealt with appropriately, to enhance the public's trust in technological advancements.

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. So far, the capacities of technologies to change behaviors and to continuously monitor the progress and effects of interventions are not being used to its full potential. Specific aspects of the intervention (its content or the system) contributing to the results and user adherence often remain unknown, known as the 'black box' phenomenon [7].

The use of technologies as persuaders may shed a new light on the interaction process of persuasion, influencing attitudes and behaviors. Yet although human-computer interactions are social in nature and people often do see computers as social actors, it is still unknown how these interactions re-shape attitude, beliefs, and emotions, or how they change behavior, and what the drawbacks are for persuasion via technologies. Humans re-shape technology, changing their goals during usage. This means that persuasion is not a static ad-hoc event but an ongoing process.

Validated and suitable evaluation methods are needed, as well as mixed-methods approaches to measure engagement, emotions, and social influence of persuasive technologies in smart environments. BCSSs pose a number of specific challenges, such as personal goal-setting, personalized feedback, support for computer-mediated communication, 24/7 availability, feasible business models, as well as suitable methods and processes to develop scalable software platforms and architectures for these systems.

**Topics**

Topics for submissions include, but are not 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.

### *Methods*

This interactive workshop will provide a platform where students, researchers, experts and practitioners will: A) present their work, B) discuss and pitch ideas on how to develop a mutual and broader understanding of Behavior Change models using the BCSSs, and C) set the first stage in defining the pillars for persuasive technology.

### 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.: A foundation for the study of behavior change support systems. Personal and ubiquitous computing. 17(6), 1223-1235 (2013).
4. Mayer-Schonberger V, Cukier K.: Big Data: A revolution that will transform how we live, work and think. Houghton Mifflin Harcourt, New York (2013)
5. Klous S, Wielaard N.: We are big data. The future of our information society. [Wij zijn big data. De toekomst van de informatiesamenleving]. Business Contact, Amsterdam (2014)
6. Murdoch T.B., Detsky A.S.: The inevitable application of big data to health care. JAMA. 309(13), 1351-1352 (2013)
7. Oinas-Kukkonen, H., Harjumaa, M.: Persuasive systems design: Key issues, process model, and system features. Communications of the Association for Information Systems. 24(1), 28 (2009)

## Proposal 1b: Challenges of Designing and Evaluating Persuasive Coaching Strategies for Technologies Supporting Health and Well-being

Roelof de Vries[1], Randy Klaassen[1,2], Robby van Delden[1], Dirk Heylen[1], Gert Jan van der Burg[3], Pam Kato[4], Cindy Veenhof[5,6], & Joep Janssen[7]

[1]Human Media Interaction, University of Twente, The Netherlands
[2]CTIT Centre for Monitoring and Coaching, University of Twente, The Netherlands
[3]Gelderse Vallei Hospital, Ede, The Netherlands
[4]Serious Games Games Institute, Coventry University, UK
[5]Rehabilitation, Nursing Sciences & Sport, University Medical Center Utrecht, The Netherlands
[6]Innovation in Exercise Care, University of Applied Sciences Utrecht, The Netherlands
[7]Hoogstraat Rehabilitation Center, Utrecht, The Netherlands

**General theme**: All the challenges that we run into in the domain of health and well-being while trying to 'successfully coach people through the use of technology'.

### Background

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. 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., [3,8,10]), to personalize or tailor effectively (e.g., [1,6,11]), to implement theoretical knowledge into technology (e.g., [3,5,10]), to evaluate constructs, strategies or methods in-the-wild in various contexts (e.g., [4,8,12]), to effectively make use of new possibilities in sensing and monitoring people in daily life (e.g., [1,7,9]), 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., [2,5,11]).

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. Stakeholders 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, is also

acknowledged by and reflected in current research policies and projects (e.g. in Horizon 2020 - WP 8 Health, Demographic change and well-being[1]).

## Overview of the workshop

### *Format types of activities*

This is the 1st workshop on "Challenges of Designing and Evaluating Persuasive Coaching Strategies for Technologies Supporting Health and Well-being". This half-day workshop will include time for discussion after presentations of invited speakers, and also allocates time for discussion after the respective presentations. We encourage attendees of the Persuasive Technology conference to participate in these discussions and let each other benefit by creating new insights this way.
Our schedule includes presentations of accepted submissions, which is a good way to disseminate the results to the attendees of the workshop, but also includes sufficient time for discussions after the presentations tostir up discussion. After the keynote, the presentations and discussions we plan to wrap up with an overall discussion of the most notable topics that came by during the workshop to discuss the future of our common research direction. Our goal is to make sure that all attendees in this session get a chance to share their insights in discussions, either after the keynote, after each submission presentation, or in the overall wrap up. Depending on the number of submissions, we can rework the submission presentations into either separate presentations or poster rounds with teaser presentations.

### *Topics*

We welcome papers related to the various aspects of smart monitoring, persuasive coaching and behavior change strategies in technology, especially those focused on: (1) application areas of health and well-being, (2) various approaches from more theoretical (e.g., behavior change theory) to more practical (e.g., implementation of smart monitoring systems and exertion interfaces) or combinations (e.g., serious games and wellness technology), (3) using various technologies for coaching (e.g., smartphones, smart sensors, and even augmented or virtual reality),(4) various evaluation methodologies (e.g., qualitative, quantitative, or mixed methods, and the possibility of incorporating technology to obtain data), and also (5) on the implementation of the results in daily practice.

### *Target audience*

The target audience includes researchers working on health and well-being on the areas of smart monitoring, persuasive coaching, or behavior change strategies, but also researchers focusing on any of the topics we described in the previous section. We invite people with all kinds of backgrounds that face the challenges of building and evaluating technologies and strategies for coaching. We will invite people to join our workshop through our extensive interdisciplinary network, as represented by the formation of our organizing committee. Willingness and interest to reflect on the challenges of effective coaching through technology is the only prerequisite to participate in the workshop.

[1]http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-health_en.pdf

### *Position paper requirements*

We accept submissions of papers up to 3 - 6 pages (A4) for position papers, and up to 10 pages for research findings, including references. The submissions must be submitted in PDF format and they should conform to the LNCS template (see https://www.springer.com/computer/lncs?SGWID=0-164-6-793341-0). If you want to submit something but it does not fit in the standard format please contact one of the organizers to see if we can accommodate you. Authors' names and affiliations are required. Submissions will be selected on the relevance of the contribution in regard to the potential to generate interesting discussion at the workshop. The goal of the workshop is to discuss all the challenges we run into while developing effective coaching strategies and technologies. Therefore, in the papers, the authors should reflect on the challenges they run into and on the (possible) way they overcome these challenges.

### *Expected outcome*

To document the results of the workshop, we will make all the workshop proceedings accessible online on the workshop website, where we will also provide a summary of the challenges discussed at the workshop. Furthermore, we are considering a special issue for the Journal Frontiers in Human-Media-Interaction. In case of this special issue we will select certain contributions from this workshop to be extended and to be submitted to this special issue.

## References

1. Op den Akker, H., Klaassen, R., op den Akker, R., Jones, V. M., & Hermens, H. J. (2013). Opportunities for smart & tailored activity coaching. In CBMS (pp. 546-547).
2. Chatterjee, S., & Price, A. (2009). Healthy Living with Persuasive Technologies: Framework, Issues, and Challenges. Journal of the American Medical Informatics Association, 16(2), 171–178.
3. Consolvo, S., McDonald, D. W., & Landay, J. A. (2009). Theory-driven design strategies for technologies that support behavior change in everyday life. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 405–414).
4. van Gemert-Pijnen, J.E.W.C, Nijland, N., van Limburg, M., Ossebaard, H.C., Kelders, S.M., Eysenbach, G., and Seydel, E.R., (2011) A holistic framework to improve the uptake and impact of ehealth technologies. Journal of medical Internet research, 13(4).
5. Hekler, E. B., Klasnja, P., Froehlich, J. E., & Buman, M. P. (2013). Mind the Theoretical Gap: Interpreting, Using, and Developing Behavioral Theory in HCI Research. Proc. CHI 2013, 3307– 3316.
6. Kaptein, M. C. (2015). Formalizing customization in persuasive technologies. In International Conference on Persuasive Technology (pp. 27-38). Springer International Publishing.
7. Klasnja, P., Consolvo, S., McDonald, D. W., Landay, J. A., & Pratt, W. (2009). Using mobile & personal sensing technologies to support health behavior change in everyday life: lessons learned. In AMIA Annual Symposium Proceedings (Vol. 2009, p. 338).
8. Klasnja, P., Consolvo, S., & Pratt, W. (2011). 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).
9. Klasnja, P., & Pratt, W. (2012). Healthcare in the pocket: Mapping the space of mobile-phone health interventions. Journal of Biomedical Informatics, 45(1), 184–198.
10. Michie, S., Richardson, M., Johnston, M., Hardeman, W., Eccles, M. P., Cane, J., & Wood, C. E. (2013). The Behavior Change Technique Taxonomy ( v1 ) of 93 Hierarchically Clustered Techniques: Building an International Consensus for the Reporting of Behavior Change Interventions, 81–95.
11. Oinas-Kukkonen, H. (2010). Behavior change support systems: A research model and agenda. In Persuasive Technology (pp. 4–14). incollection, Springer.
12. Oinas-Kukkonen, H. and Harjumaa, M. (2008) A systematic framework for designing and evaluating persuasive systems. In Proceedings of the 3rd international conference on Persuasive Technology, PERSUASIVE '08, pages 164–176, Berlin, Heidelberg, 2008. Springer-Verlag.

## Workshop 2: Contemplating change

Deger Ozkaramanli[1], Geke Ludden[2], & Armagan Karahanoglu[2]

[1]University of Liverpool, UK
[2]University of Twente, The Netherlands

The central aim of this workshop is to bring together experts from academia and industry to reflect on and to discuss persuasive technology in the early stages of health behavior change (i.e., pre contemplation and contemplation stages). Tackling the challenges that current state of the art in health behavior change products and systems (BCPS) face requires multidisciplinary expertise from fields such as psychology, computer science, interaction design, design methodology, philosophy and beyond. Furthermore, we aim to initiate a body of knowledge that is both theoretical in nature (e.g., methodological underpinnings of designing for behavior change) and transferrable to practice (e.g., application in case studies across various health domains).
This workshop aims to integrate research papers with design cases to acknowledge both the theoretical and practical sides of this domain. We therefore welcome submissions in two categories: (1) research papers that can focus on theory, models, or frameworks around designing for health behavior change, with a particular focus on the pre-contemplation and contemplation stages. (2) design cases to be communicated through pictorials (i.e., annotated images that explain the story of how and why a product or service was developed).

### Introduction

The official WHO (1948) definition of health is "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity". This definition of health has been debated, arguing against it that it would "leave most of us unhealthy most of the time" (Smith, 2008). But what this definition does point out that how to be and stay healthy (or perhaps even be healthier than we are at the present time) is something that we need to consider throughout our lives. Over the last decades, we have seen a rapid increase of products and systems designed to support people in adopting healthier lifestyles. In 2015, an astonishing number of 165,000 mobile health applications were available on smartphone platforms, which was almost two times more than in 2013 ("Things are looking app", 2016). Such systems may play an important role in raising awareness about the necessity of change and motivating people to adopt and sustain change in health behaviors. However, so far, most of these systems seem to focus on action and motivation at the moment where people have already decided that they need and want to change a specific behavior (see Ludden & Hekkert, 2014 for a review). As such, they are often not able to reach the large group of people that has not yet considered change.
Even for the group that does consider change, the process of change is slow, complex, and difficult. Siegel and Beck (2014) emphasize that any attempt to design for behavior change should start by acknowledging the intricate nature of this process. The complex nature of human behavior is often manifested in our personal dilemmas. For instance, we may want to have a healthier lifestyle than we already do: we want to cook healthier meals, exercise more regularly, stop smoking, drink less alcohol, get enough sleep and so on. But we also want to eat in that nice new restaurant with friends, spend time with our children or friends, and perform well at work. These goals and desires often conflict in everyday life, leaving people 'caught in the horns of a dilemma' (Riediger & Freund, 2004; p. 1). Dealing with personal dilemmas requires setting priorities, carefully managing personal resources (e.g., time and energy), and regulating emotional states (e.g., moods, desires). Therefore, products designed

to support people in changing their behavior can benefit from an understanding of personal dilemmas and the approaches designers can use to respond to them (Ozkaramanli, Desmet, & Ozcan, 2016).
Moreover, to consider the full process of behavior change, it can be helpful to consider different stages of change as defined in the transtheoretical model of health behavior (TTM) (Prochaska & Velicer, 1997). The TTM defines five stages that range from the moment where people are not yet aware that making certain changes would be beneficial for their health to the moment where a sustained behavior change has been made.
One of the main challenges is to know which unhealthy behavior to change and how to change it taking all aspects of our lives in consideration. For example, some people are stuck in the contemplation stage for long periods of time (chronic contemplation). Also, many people relapse from action or maintenance stages to an earlier stage, mostly to contemplate or prepare for another serious attempt at action. This is an aspect of health behavior change that, in our opinion, has so far not been addressed by technology that is aimed at health behavior change.
In summary, to further increase the effectiveness of health interventions, designers could adopt stages of change theory with a specific focus on personal dilemmas during the pre-contemplation and contemplation stages. This would enable them to design for the way people actually behave, and not for the way they want them to behave (Norman, 2007). This may seem contradictory, since the aim of these interventions IS to change people (or at least their behavior). However, as Prochaska and Velicer (1997) put it: instead of expecting people to match the needs of the interventions, the interventions need to match the motivational states of people. Here, analyzing people's dilemmas enable designers to understand the motivational and emotional underpinnings of how people choose among particular behavioral alternatives. For instance, one may want to get some exercise every morning to be energetic or to lose weight. Alternatively, one may want to linger in bed (instead of exercising) to get more sleep or to spend more time with his/her partner. Being aware of the actual motivations behind such competing choices enable designers to make more informed choices while designing health interventions. As a result, users are more likely to recognize these interventions as matching their motivational states, and will adopt and use them, which is essential for moving forward through the stages of change (Kuru & Forlizzi, 2015). For instance, when the technology becomes too interruptive (for example by constantly prompting the user to go out and take more steps), the user tends to stop using the technology because it conflicts with his or her needs at that moment (the user was sick and was resting at home). People want to be able to put their trust in the technology and expect the interventions to be "timely" and "reasonable" enough. Thus, the technology should be adaptive to the changing user needs and states so that the user can depend more on the technology and make better decisions.

**Aims of the workshop**

The central aim of this workshop is to bring together experts from academia and industry to reflect on and to discuss persuasive technology in the early stages of health behavior change (i.e., pre contemplation and contemplation stages). Tackling the challenges that current state of the art in health behavior change products and systems (BCPS) face requires multidisciplinary expertise from fields such as psychology, computer science, interaction design, design methodology, philosophy and beyond. Furthermore, we aim to initiate a body of knowledge that is both theoretical in nature (e.g., methodological underpinnings of designing for behavior change) and transferrable to practice (e.g., application in case studies across various health domains). As a result, the topics of interest for this workshop include theoretical work focusing on frameworks and models for developing health BCPS as well as (design) case studies to demonstrate the application of such theoretical work. This overall aim translates to the following three sub-aims:

1. Understanding the challenges people face in the early stages of behavior change (i.e., pre-contemplation and contemplation stages) to inform the design of more “fit to purpose” products and services
2. Evaluating how design of online and mobile interventions and the design of emerging, more tangible, integrated and distributed interactions currently tackle health behavior change.
3. Creating a framework for the future of designing health interventions: what are the (1) theoretical and (2) practical, opportunities and challenges that face us?

As the overall aim of the workshop is to stimulate multidisciplinary engagement in designing better-targeted health BCPS, the program includes several interactive parts that are designed to engage participants in discussion and that will (hopefully) lead to a better understanding of what future research and development in this field could look like. More specifically, the workshop aims to integrate research papers with design cases to acknowledge both the theoretical and practical sides of this domain. The organizers will call for traditional research papers that can focus on theory, models, or frameworks around designing for health behavior change, with a particular focus on the pre-contemplation and contemplation stages. In addition, the organizers will call for design cases to be communicated through pictorials (i.e., annotated images that explain the story of how and why a product or service was developed) to ensure participation of design practitioners or practice-oriented researchers in this field. Besides paper contributions, we welcome researchers and practitioners in fields such as industrial design, psychology, computer science, philosophy, and beyond, to join the workshop discussions. To ensure the quality of the discussions and the outcome, we limit the places in the workshop to 20 participants.

## References

1. Ludden, G.D.S. & Hekkert, P. (2014). Design for healthy behavior. Design interventions and stages of change. In J. Salamanca, P. M. A. Desmet, A. Burbano, G. Ludden and J. Maya (Eds.), The Colors of Care: Proceedings of the 9th International Conference on Design and Emotion, Bogotá, Colombia, 6-10 October. Bogotá: Ediciones Uniandes.
2. Kuru, A. & J. Forlizzi, (2015). Engaging Experience with Physical Activity Tracking Products. In A. Marcus (Ed.), 4th International Conference DUXU 2015, Held as Part of HCI International 2015, (pp. 490–501). San Francisco: Springer.
3. Norman, D. A. (2007). The Design of Future Things. New York: Basic Books.
4. Ozkaramanli, D., Desmet, P. M. A., & Özcan, E. (2016). Beyond resolving dilemmas: Three design directions for addressing intrapersonal concern conflicts. Design Issues, 32(3), 78-91.
5. Prochaska, J. O., & Velicer, W. F. (1997). The Transtheoretical Model of Health Behavior Change. American Journal of Health Promotion, 12(1), 38-48.
6. Riediger, M., & Freund, A. M. (2004). Interference and facilitation among personal goals: Differential associations with subjective well-being and persistent goal pursuit. Personality and Social Psychology Bulletin, 30(12), 1511-1523.
7. Siegel, M. & Beck, J. (2014). Slow change interaction design. Interactions, XXI.1, p. 28.
8. Smith R. (2008, 8 July). The end of disease and the beginning of health. Retrieved from BMJ Group Blogs 2008. http://blogs.bmj.com/bmj/2008/07/08/richard-smith-the-end-of-disease-and-the-beginning-of-health/. Last accessed 15 November 2016.
9. Things are looking app. (2016, 12 May). The Economist. Retrieved from: http://www.economist.com/news/business/21694523-mobile-health-apps-are-becoming-more-capable-and-potentially-rather-useful-things-are-looking. Last accessed on 15 November 2016.

# Workshop 3: Personalizing Persuasive Technologies: Progress, Challenges, and Opportunities

Rita Orji[1], Marc Busch[2], Michaela Reisinger[2], Arie Dijkstra[3], Maurits Kaptein[4], & Elke Mattheiss[2]

[1]University of Waterloo, Canada
[2]Austrian Institute of Technology, Austria
[3]University of Groningen, Netherlands
[4]University of Tilburg

✉ rita.orji@uwaterloo.ca, marc.busch@ait.ac.at, arie.dijkstra@rug.nl, {michaela.reisinger, elke.mattheiss}@ait.ac.at, m.c.kaptein@uvt.nl

Personalizing persuasive technologies can increase their efficacy at motivating the desired behavior change. Building on the success of the 2016 workshop which witnessed 16 paper presentations, 2 keynote presentations, and 43 participants from over 10 different countries, this year's workshop aims to advance the research area even further by addressing outstanding challenges and opportunities identified during the previous workshop. The workshop aims to connect a diverse group of researchers and practitioners interested in personalizing and tailoring persuasive technologies to share their experiences, ideas, discuss key challenges facing the area, and how to move the field forward. The workshop will cover broad areas of personalization and tailoring, including but not limited to personalization models, design and evaluation methods, and personalized persuasive technologies. We welcome submissions and ideas from any domain of persuasive technology and HCI including, but not limited to health, sustainability, games, safety and security, marketing, eCommerce, entertainment, and education. Workshop papers and ideas will be archived online to be accessible to the general public. For more information see: https://personalizedpersuasion.wordpress.com/

**Keywords**: Personalization, tailoring, persuasive technology, captology, persuasion

## Introduction

Research in the area of Persuasive Technology and Behavior Change Support Systems face a number of scientific challenges that present great opportunities for advancing research in this field. One of the most significant of these challenges is the issue of personalizing persuasive technologies. Personalizing persuasive technologies is the act of tailoring persuasive technologies to the target audience to increase their relevance, motivational appeal, and hence their overall effectiveness. Although recent research has shown that personalizing persuasive systems will increase their efficacy at motivating the desired behavior change [1–4] and that a persuasive approach that works well with one group of people may demotivate a different group [2, 5], there is little knowledge on how persuasive technologies can be tailored. While personalizing user interfaces and systems in general has received reasonable attention from the Human-Computer Interaction (HCI) researcher community in general [6], most of the findings may not be readily applicable in personalizing persuasive systems as the effectiveness of the systems are not only determined by their ability to elicit a positive user experience but ultimately by their ability to motivate the desirable behaviour change. Moreover, the effectiveness of various persuasive approach will vary depending on the target user type, the context of use, and the target behaviour [7, 8].

This realization has led to a growing interest in finding ways of personalizing and tailoring persuasive systems. However, so far, only few attempts have been made toward personalizing

various persuasive technologies or developing approaches for personalizing persuasive technology. For example, research has suggested that individual characteristics such as personality type [9–11], age [8], gender [12, 13],
gamer type [5, 14, 15], and culture [16, 17] as well as individual's susceptibility to persuasive attempts [2, 18] can be useful dimensions for tailoring. Research has also explored how various psychological processes can be used to explain the persuasive effect of tailoring [3, 19, 20]. However, there are still many unexplored issues pertaining to designing, implementing, and evaluating personalized persuasive systems and the efficacy of personalized persuasive systems in different domains.
The first edition of this workshop that was held in conjunction with the Persuasive Technology Conference in 2016 witnessed 16 papers that contributed in advancing research on personalizing persuasive technologies in various ways including methods, theories, systems, and domains [21, 22]. The workshop attracted 43 participants from over 10 different countries and offered a platform for networking and exchanging of ideas for scholars and practitioners from both academia and industry. This year's full-day workshop aims to build on the success of the previous edition and advance the research area even further by addressing outstanding challenges and opportunities identified during the previous workshop [21] (e.g., the difference between Adaptivity and Adoptivity, system-controlled and user-controlled personalization) while identifying new ones.

**Goals and Core Questions**

The full-day workshop will bring together the academic and industrial community interested in personalizing persuasive technologies to brainstorm and jointly explore these topics and define a roadmap for future research in this area.
In this context, we want to explore the following topics and questions:

- Frameworks and models for developing personalized persuasive technology
- Objective and subjective approaches to personalizing persuasive technologies
- Methods and Metrics for evaluating the effectiveness of personalized persuasive technology
- Long-term evaluation and evidence of long-term effect of personalized persuasive technology
- Systematically investigating and highlighting the difference between Adaptivity and Adoptivity
- Systematically investigating and highlighting the difference between system-controlled personalization and user-controlled personalization
- The relationships between individual characteristics and effectiveness of various persuasive technology features
- How to balance the cost and benefit of personalizing persuasive technology (the level of personalization required for a maximum return on investment)
- How to develop ethical and privacy-sensitive personalized persuasive technology
- What do we personalize (for example, do we personalize the persuasive strategies, approaches, or end-goals)?
- How do we personalize (e.g., subjective and objective personalization methods)?
- Who do we personalize for (e.g., personality, gender, age, persuadability, player types, emotional states, contextual/situational variables)?
- Where do we personalize domain and context dependency of personalization approaches?
- Challenges and limitations of implementing personalized persuasive technology and possible solutions.
- Case studies and examples of personalized persuasive technologies.
- Success and failure stories with regard to personalized persuasive technology.
- Other relevant dimensions of personalizing persuasive technologies.

## Workshop format

This will be an interactive workshop structured to encourage discussion and active collaboration among attendees. The workshop will feature a keynote talk, presentation sessions for position papers, breakout sessions, and a final discussion session to wrap up the event.

## Workshop Outcomes

Through critical reflection, presentations, and brainstorming, the workshop will outline a roadmap for personalization in persuasive technology research with a focus on improving relevance and overall effectiveness of persuasive technology. It will contribute an overview of the state of the art in persuasive technology research addressing the issue of personalization, and outline challenges and opportunities. It is planned to establish a working group that will continue to discuss and collaborate on issues personalization in persuasive technology.

## References

1. Orji R (2014) Design for Behaviour Change: A Model-driven Approach for Tailoring Persuasive Technologies. PhD Thesis:1–257.
2. Kaptein M, De Ruyter B, Markopoulos P, Aarts E (2012) Adaptive Persuasive Systems. ACM Trans Interact Intell Syst 2:1–25. doi: 10.1145/2209310.2209313
3. Dijkstra A (2014) The persuasive effects of personalization through: name mentioning in a smoking cessation message. User Model User-adapt Interact 24:393–411. doi:
4. Busch M, Mattheiss E, Hochleitner W, et al (2016) Using Player Type Models for Personalized Game Design - An Empirical Investigation. Int. J. Interact. Des. Archit.
5. Orji R, Mandryk RL, Vassileva J, Gerling KM (2013) Tailoring persuasive health games to gamer type. In: Proc. SIGCHI Conf. Hum. Factors Comput. Syst. - CHI '13. ACM Press, New York, New York, USA, pp 2467–2476
6. Egan D (1988) Individual differences in human-computer interaction. Handb Human-computer Interact M Helander (ed) Elsevier Sci Publ Amsterdam 543–568.
7. Oinas-kukkonen H, Harjumaa M (2009) Persuasive Systems Design : Key Issues, Process Model , and System Features Persuasive Systems Design : Key Issues , Process Model , and System Features. Commun Assoc Inf Syst 24:28.
8. Orji R, Mandryk RL, Vassileva J (2015) Gender, Age, and Responsiveness to Cialdini's Persuasion Strategies. In: Persuas. Technol. pp 147–159
9. Halko S, Kientz JA (2010) Personality and Persuasive Technology: An Exploratory Study on Health-Promoting Mobile Applications. In: Persuas. Technol., pp 150–161
10. Arteaga SM, Kudeki M, Woodworth A, Kurniawan S (2010) Mobile system to motivate teenagers' physical activity. In: Proc. 9th Int. Conf. Interact. Des. Child. ACM, Barcelona, Spain, pp 1–10
11. Alkış N, Taşkaya Temizel T (2015) The impact of individual differences on influence strategies. Pers Individ Dif 87:147–152. doi: 10.1016/j.paid.2015.07.037
12. Orji R, Mandryk RL, Vassileva J (2014) Gender and Persuasive Technology: Examining the Persuasiveness of Persuasive Strategies by Gender Groups. In: Adjun. Proc. 9th Int. Conf. Persuas. Technol. pp 48–52
13. Orji RO, Vassileva J, Mandryk RL (2013) Modeling Gender Differences in Healthy Eating Determinants for Persuasive Intervention Design. Persuas Technol 7822:161– 173. doi: 10.1007/978-3-642-37157-8
14. Orji R, Vassileva J, Mandryk RL (2014) Modeling the efficacy of persuasive strategies for different gamer types in serious games for health. User Model User-adapt Interact 24:453–498. doi: 10.1007/s11257-014-9149-8
15. Busch M, Mattheiss E, Orji R, et al (2015) Personalization in Serious and Persuasive Games and Gamified Interactions. In: Proc. 2015 Annu. Symp. Comput. Interact. Play - CHI Play '15. ACM Press, New York, New York, USA, pp 811–816
16. Khaled R, Barr P, Noble J, et al (2006) Our place or mine? Exploration into Collectivism-Focused Persuasive Technology Design. Persuas. Technol.
17. Orji R, Mandryk RL (2014) Developing culturally relevant design guidelines for encouraging healthy eating behavior. Int J Hum Comput Stud 72:207–223. doi: 10.1016/j.ijhcs.2013.08.012
18. Kaptein M, Markopoulos P (2009) Can you be persuaded? individual differences in susceptibility to persuasion. In: INTERACT. pp 115–118
19. Dijkstra A (2008) The Psychology of Tailoring-Ingredients in Computer-Tailored Persuasion. Soc Personal Psychol Compass 2:765–784.
20. Hawkins RP, Kreuter M, Resnicow K, et al (2008) Understanding tailoring in communicating about health. Health Educ Res 23:454–66. doi: 10.1093/her/cyn004

21. Orji R (2016) Preface to the International Workshop on Personalization in Persuasive Technology : Research Challenges and Opportunities Strategies Personalization in Persuasive Technology. In: Proc. Int. Work. Pers. Persuas. Technol. pp 1–5
22. Personalization in Persuasive Technology Workshop. http://ceur-ws.org/Vol-1582/.

## Workshop 4: The Ethics of Persuasive Technologies

Michael Nagenborg[1], Lily Frank[2], Margoth González Woge[1], Ching Hung[1], Saskia Nagel[1], Steven Dorrestijn[3], Andreas Spahn[2], & Peter-Paul Verbeek[1]

[1]University of Twente, The Netherlands
[2]Technical University of Eindhoven, The Netherlands
[3]Saxion University, The Netherlands

Persuasion and ethics have an uneasy and complicated relationship. On the one hand, persuasiveness, or rational influence or eloquence can be understood as a virtue, which enables a virtuous person to support others to also aspire to virtue. On the other hand, persuasion is met with suspicion. It seems to undermine user autonomy.
The workshop will consist in a mix of short presentations, panels, and plenary discussions. It aims to (a) bring together experts on the Philosophy of Technology and Ethics of Technology to discuss fundamental and application-oriented questions concerning the design and use of Persuasive Technologies, and (b) To facilitate the dialogue between designer and users of Persuasive Technologies and Philosophers.

### Motivation

One doesn't need to turn to the darkest part of the history of behavior control (e.g., the use of behavior change technologies to 'convert' homosexuals in the 1970-ties) to understand the multiple ethical challenges presented in the design and use of persuasive technologies. The need to address these challenges in a responsible way is even more pressing because of the potential desirable consequences of persuasion. Technologically induced and enabled behavior change might, indeed, help us to engage in more healthy, sustainable, and community oriented lifestyles.

### Organization

#### *Introduction to the workshop*

The workshop aims to

a) bring together experts on the Philosophy of Technology and Ethics of Technology to discuss fundamental and application-oriented questions concerning the design and use of Persuasive Technologies, and
b) To facilitate the dialogue between designer and users of Persuasive Technologies and Philosophers.

#### *Agenda for the workshop*

The one day-workshop will be divided in two parts. In the morning we will focus on general questions concerning Persuasive Technologies. The afternoon will be dedicated to two application domains: eHealth and Persuasive Environments (including the potential role of persuasive design of so-called Smart Cities). The workshop will consist in a mix of short presentations, panels, and plenary discussions.

### Morning: General issues

*Session 1: Overview on current ethical challenges in persuasive technologies*
The first session will be dedicated to mapping out the most pressing ethical issues in the design and use of Persuasive Technologies as well as fundamental questions concerning Persuasive Technologies. This may include: How to define persuasion in contrast to manipulation or nudging? What sets Persuasive Technologies apart from other technologies?

Is there a need for a specific Ethics of Persuasive Technologies? How to conceptualize shared responsibility in the use of Persuasive Technologies? E.g., what are the specific responsibilities of designers, doctors, and patients for the medical use of Persuasive Technologies? And how to address the intersection between surveillance and persuasion? On an even more fundamental level, Persuasive Technologies present a challenge to the traditional liberal understanding of human autonomy. Therefore, we will also address the question concerning human-technology relations including the active role of technology in shaping human behavior.

*Session 2: Ethics and design of Persuasive Technologies*
Many ethical questions arise in the design-phase of persuasive technologies. Various methods have been suggested to ensure that ethical aspects are being considered in the design of Persuasive Technologies (e. g., value sensitive design, participatory design, and mediation analysis). We will discuss these different methods in light of their pros and cons while focusing on how Persuasive Technologies could respect the autonomy of the users.

***Afternoon: Specific challenges***

*Session 3: eHealth and persuasion*
Persuasive Technologies can improve health and quality of life. One application of Persuasive Technologies that hold promise are those that allow the elderly to maintain independence and for individuals with chronic diseases to control their conditions. Healthcare systems are increasingly extended from the doctor's office to people's home environments, as they become increasingly mobile, through, for example, smartphones that send and receive laboratory results. Persuasive ehealth technologies raise ethical and social issues by impacting the doctor-patient relationship; altering the meaning of health-related behaviors and characteristics (medicalization); and posing conflicts between values like autonomy and privacy, among others. In this session, we will focus on the following challenges:
*Persuading vulnerable people*: Although difficult to define, vulnerable populations (chronically ill, elderly, children, the cognitively impaired) stand to benefit a great deal from persuasive and ehealth technologies, while simultaneously being at risk of being harmed by them. This is of particular concern if the users of the ehealth Persuasive Technologies have diminished insight into their mechanisms and purposes.
*Trust as key to responsible persuasion*: User's trust in these technologies is crucial for people to adopt them, use them effectively, and be open to incorporating them into their decision-making processes. How can users' expectation be met by a reassuring feeling of confidence in the technology? Furthermore, how can designers and regulators ensure that trust is well-placed?
*The value and implications of prevention*: Persuasive technologies can motivate and support healthier lifestyle decisions related to diet, exercise, smoking, social relationships, and stress. While these can help prevent diseases and thereby reduce healthcare costs, there is also a risk of medicalization. By medicalization we mean the phenomenon by which a characteristic, problem, or behavior changes from being considered a choice or preference or a normal part of human life to becoming a subject of study and treatment by the medical establishment. Whether or not this phenomenon will occur and, more importantly, whether it is a form of morally good or bad medicalization should be explored.

*Session 4: Persuasive environments*
The last session will be dedicated to discuss the use of Persuasive Technologies within so-called Open Living Labs, as well as their potential roles as they become a central part of Smart Cities. A persuasive environment can be understood as a combination of several

persuasive technologies, either material or seamless, aimed to influence people's agency in a relatively large scale. They are usually deployed without any informed consent, making the ethical questions concerning Persuasive Technologies become political ones. In this sense we will discuss the following: Will smart environments be a product of technocracy? Will they become a governmental manipulation, based on scientific and engineering knowledge about human beings? What are the implications for democracy, if citizens are under the constant influence of Persuasive Technologies? In which cases will it be permissible to "use" them in a large-anonymous context?
While the final subject of our workshop is the most speculative, we will use the thought experiment of a large scale "persuasive environments" as an opportunity to explore the political nature of Persuasive Technologies.

**Expected outcome**
The workshop will provide the participants with an overview of the current state-of-the-art of the Ethics of Persuasive Technologies and will facilitate the exchange between researchers working in different domains.
We further aim to draft a roadmap for future research for the ethics of persuasive technologies.

**References**
1. Berdichevsky, D., & Neuenschwander, E. (1999). Toward an ethics of persuasive technology. Communications of the ACM, 42(5), 51-58.
2. Calo, Ryan (2014) 'Digital Market Manipulation', The George Washington Law Review, Vol. 82, pp. 995 – 1051.
3. Dorrestijn, S., & Verbeek, P. P. (2013), Technology, well-being, and freedom: The legacy of utopian design. In: International Journal of Design 7(3), 45-56. open access download
4. Dorrestijn, S. (forthcoming), The Product Impact Tool: And the Case of the Dutch Public Transport Chip Card. In Niederer, K., G. Ludden & S. Clune (eds.), Design for Behaviour Change (Ashgate Design for social responsibility series) (ch 4). Farnham, UK: Glower.
5. Norman, D. (2007). The design of future things. 2007. New York: Basic Books.
6. Pasquale, F. (2015) The Black Box Society: The Secret Algorithms That Control Money and Information. Cambridge: Harvard University Press.
7. Spahn, A. (2012). And Lead Us (Not) into Persuasion…? Persuasive Technology and the Ethics of Communication. Science and Engineering Ethics, 18(4), 633–650.
8. Spahn, A. (2013). Moralizing mobility? Persuasive technologies and the ethics of mobility. Transfers, 3(2), 108-115.
9. Sunstein, C. R. (2015). Why Nudge?: The Politics of Libertarian Paternalism (Reprint edition). Yale University Press.
10. Tufekci, Zeynep (2015) 'Algorithmic harms beyond Google and Facebook: Emergent Challenges of Computational Agency', Colorado Technology Law Journal, Vol. 13, pp. 203 – 218.

# Symposium

**Symposium Chair**

Peter de Vries University of Twente, The Netherlands

# Tailored interactive technology for a healthy lifestyle

Marije Baart de la Faille[1,2], Joan Dallinga[1], Sumit Mehra[2], Joey van der Bie[2], Nicky Nibbeling[2], & Monique Simons[3,4]

[1] Inholland University of Applied sciences, Haarlem, The Netherlands
[2] Amsterdam University of Applied Sciences, Amsterdam, The Netherlands
[3] Utrecht University, Utrecht, The Netherlands
[4] Municipality Utrecht, The Netherlands

## Abstract

During the last five years the use of creative technology (e.g. smartphone applications, beacons, smart watches) to impose a healthy lifestyle has increased enormously [1, 2]. Creative technologies seem a promising method to increase physical activity in a variety of target groups among which children, elderly, and novice runners. In the current symposium, researchers working in the mentioned target groups will present their work and share their experiences and ideas. For children, gamification is a promising method to increase intrinsic motivation to participate in exercise interventions as games make participation fun [3]. Moreover, it appears that physical activity mobile phone games more often contain behavior change constructs than non-game health apps, and are therefore potentially very effective in motivating children to be more active [4]. For elderly, there is ongoing work on the utilization of digital tools such as tablets to stimulate elderly to exercise more and support self-regulation. For novice runners, the combination of apps and beacons is potentially effective in increasing physical activity. Beacons can be integrated into public spaces and offer the possibility to tailor feedback to the individual user, for example through game instructions and location specific exercise instructions [5]. Finally, the number of smartphone applications that can be downloaded in app stores is increasing rapidly, however it is not clear which app fits which user. A first step towards a decision tool for app use is increasing knowledge on the components that an exercise app should contain. In the last presentation we will focus on which app features are important in an app. With this knowledge the health enhancing effects of apps can be improved.

## Goal and course of the symposium

In the 'tailored creative technology for a healthy lifestyle' symposium four presentations will be provided. The goal is to provide examples of tailored, interactive technologies that stimulate people to adopt an active lifestyle.

## Content

- Introduction
- Presentation 1: A home based exercise program: are older adults able to use mHealth technology? (Sumit Mehra).
- Presentation 2: Promoting healthy diet and physical activity in children through the use of games: bridging the gap between industry and science (Monique Simons)**.**
- Presentation 3: Increased motivation for exercise through exercise apps such as BAMBEA (Joey van der Bie & Nicky Nibbeling)
- Presentation 4: Which factors are important for effectiveness of sport- and health-related apps? Results of focus groups with experts (Joan Dallinga).
- Discussion

## Discussion topics:

1) How to deal with innovations as health care professional?
2) What are the best ways to create user engagement and adherence?
3) Blended interventions: how to combine the best of both worlds?

4) How to collect user data while guaranteeing privacy?

**Match between symposium and PT theme "Smart monitoring and persuasive coaching"**
The researchers presenting in this symposium have backgrounds in the fields of behavior change (applied psychology), system design and human movement sciences. In the applications they develop their expertise is combined to develop persuasive technology. Theory from the field of behavior change, exercise psychology and human movement sciences are combined in order to develop scientifically based technologies that fit the user in different exercise encouraging settings. As the symposium covers topics such as behavior change, creative technology, personalized feedback, coaching, gamification and big data, it perfectly fits the PT theme.

## References

1. Middelweerd A, Mollee JS, van der Wal CN, Brug J, Te Velde SJ. Apps to promote physical activity among adults: a review and content analysis. Int J Behav Nutr Phys Act. 2014 Jul 25;11:97. doi: 10.1186/s12966-014-0097-9.
2. West JH1, Hall PC, Hanson CL, Barnes MD, Giraud-Carrier C, Barrett J. There's an app for that: content analysis of paid health and fitness apps. J Med Internet Res. 2012 May 14;14(3):e72. doi: 10.2196/jmir.1977.
3. Simons M, Brug J, Chinapaw MJ, de Boer M, Seidell J, de Vet E. Replacing Non-Active Video Gaming by Active Video Gaming to Prevent Excessive Weight Gain in Adolescents. PLoS One. 2015 Jul 8;10(7):e0126023. doi: 10.1371/journal.pone.0126023.
4. Payne HE, Moxley VB, MacDonald E. Health Behavior Theory in Physical Activity Game Apps: A Content Analysis. JMIR Serious Games. 2015 Jul 13;3(2):e4. doi: 10.2196/games.4187.
5. Dallinga JM, Janssen M, van der Bie J, Nibbeling N, Krose B, Goudsmit J, Megens C, Baart de la Faille-Deutekom M and Vos S. De rol van innovatieve technologie in het stimuleren van sport en bewegen in de steden Amsterdam en Eindhoven. Vrijtijdstudies. 2016, 34 (2): 43-57.