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Persuasive Technology

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Preface

Persuasive technology is a vibrant interdisciplinary research field, focusing on the study, design, development, and evaluation of information technologies aimed at influencing people's attitudes or behaviors through open and transparent means. The International Conference on Persuasive Technology series brings together researchers, designers, practitioners and business people from various disciplines and a wide variety of application domains. The research community seeks to facilitate healthier lifestyles, make people feel or behave more safely, reduce consumption of renewable resources, among other notable goals, by, for instance, designing software applications, monitoring through sensor technologies, analyzing obtained data, and providing various types of coaching for users.

The *14th International Conference on Persuasive Technology* was hosted by the Department of Communication and Internet Studies at the Cyprus University of Technology in Limassol, Cyprus in April 2019, and organized in collaboration with the University of Oulu, Finland and the University of Wollongong, Australia. In previous years similar highly successful conferences were organized in Waterloo (Canada), Amsterdam (Netherlands), Salzburg (Austria), Chicago (United States), Padua (Italy), Sydney (Australia), Linköping (Sweden), Columbus (United States), Copenhagen (Denmark), Claremont (United States), Oulu (Finland), Palo Alto (United States), and Eindhoven (Netherlands). The conference addressed a wide variety of topics regarding the development of persuasive and behavior change support systems. This year papers were also solicited for two specific topics, namely Personal informatics and Gamification and gamified persuasive technologies.

After the Doctoral Consortium (April 8), the conference featured three workshops:

- Seventh International Workshop on Behavior Change Support Systems (BCSS 2019)
- Personalizing Persuasive Technologies: Personalization for Wellbeing (PPT 2019)
- The 19th Workshop on Computational Models of Natural Argument (CMNA19): The Role(s) of Argumentation in Persuasion

On that same day (April 9), four tutorials took place:
- Persuasive systems design, evaluation and research through the PSD model
- Empowering Sustainable Change: Emergence of Transforming Wellbeing Theory

At the two-day main conference (April 10 and 11), kicked-off by a keynote by Prof. Dr. Wijnand IJsselsteijn on *Minding the Gaps: From Data to Action in Quantified Self*, the 29 accepted papers and one invited research article from

the Behavior and Information Technology journal were showcased in a single-track format, along with two poster sessions that accommodated 20 scientific posters. In addition, this year two panels were hosted, one on *Bridging Theory and Design* and one on *Research Methods*.

The LNCS volume 11433 contains the accepted short and long papers presented during the main track of the conference. Of the 80 submitted papers, 29 were accepted. 80 research papers. The 185 authors came from 29 countries, with the United Kingdom, the Netherlands, and Canada being the most numerous submitters. Twenty-nine papers were ultimately accepted, which required the dedication of 67 skillful reviewers from 17 different countries (on average three reviews were written per submitted manuscript) and some tough decisions.

These adjunct proceedings include the accepted abstracts of poster submissions, the accepted position papers submitted to the doctoral consortium, as well as descriptions of the three workshops and the two tutorials that were accepted in the conference.

We would like to thank all authors, both of accepted papers and also of those who did not make it in this time, for their contributions, and the reviewers for their very valuable feedback. Furthermore, we wish to thank all of our colleagues and students who were involved in organizing the many facets of this conference.

April 2019

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A Demo of a Chatbot for a Virtual Persuasive Dialogue

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1   A Virtual Persuasive Dialogue

Presentation of knowledge in dialogue format is a popular way not only to communicate information effectively but also as a means of persuasion [1]. It has been demonstrated in games, news, commercials, and educational entertainment. Usability studies have shown that for information acquirers, dialogues communicate information more effectively and persuade stronger than a monologue most of times.

We demo a chatbot that delivers content and supports an adversarial environment in the form of virtual dialogues automatically produced from plain texts extracted and selected from documents. Given an initial query, this chatbot finds documents, extracts topics from them, organizes these topics in clusters [2] according to conflicting viewpoints, receives from the user clarification on which cluster is most relevant to her opinion, and provides the content for this cluster. This content is provided in the form of a virtual dialogue with proponents and opponents. In this virtual dialogue, the answers are derived from the found and selected documents and its split results, and questions are automatically generated for these answers. A virtual dialogue is designed to imitate an exchange of arguments between parties [3].

A virtual dialogue is defined as a multi-turn adversarial argumentation dialogue between imaginary agents obtained as a result of content transformation (Fig. 1). It is designed with the goal of effective information representation and is intended to look as close as possible to a genuine dialogue about a controversial topic. Virtual dialogues as search results turn out to be more effective means of information access and adjustment of user opinion in comparison with original documents provided by a conventional chatbot or a search engine [1].

2   A Session with a Virtual Dialogue

We present a chatbot session that not just provides a user with content on his topic of interest, but also imitates his conversations with his proponents and a dispute with his opponents, as his own opinion is expected to evolve. The user starts a session with a topic and the chatbot forms the clusters, some of them supporting a positive view of this topic and others defeating it. The chatbot consults the sources (in this case, public URLs) and extracts the content from each page (or documents) expected to be relevant for the query. The formed clusters are shown as a list so that the user can select its element that is the closest to his opinion, and also share it in his own words.

User>**ideology of political correctness**
Bot>exploring https://theimaginativeconservative.org/2015/04/the-reality-of-the-political-correctness-ideology.html
exploring https://www.spiked-online.com/2018/10/16/political-correctness-an-elite-ideology
exploring https://www.nationalists.org/pdf/political_correctness_a_short_history_of_an_ideology.pdf…
  These are the opinions on the topic. Which one do you want to argue for or against?
'criticism of its favored constituencies and ideologies'. 'commentators on the political left'. 'flagellate themselves for their white privilege'. 'an elite preoccupation should surprise no one'[2]. 'is directly derived from classical Marxism'. politically correct and politically incorrect brands…
User> **classical Marxism [3]**

Bot> Deconstruction. proves that any text, past or present, illustrates the oppression of blacks, women, homosexuals, etc. by reading that meaning into words of the text (regardless of their actual meaning). For cultural Marxists, the analysis is linguistic.

Please provide your arguments for/against the claim or proceed to virtual dialogue

User > **I think Marxism does not necessarily associated with the political correctness**

Bot> This is what other people who are your opponents chat about the topic:

> User1> 80 Percent Of Americans Think Political Correctness Is An Issue?
>
> Bot1> Among devoted conservatives, 97% believe that political correctness is a problem.
>
> User2> 10 Hilarious Examples Of Political Correctness Gone Mad?
>
> Bot2>Progressive activists are the only group that strongly backs political correctness
>
> User3> What happens in the country sank into political correctness?
>
> Youth isn't a good proxy for support of political correctness and it turns out race isn't either. Whites are ever so slightly less likely than average to believe …

User> **Is it OK to have an ideology in general?**

Bot> These are the fragments from the thread that try to convince you:

> User3> Do you want to abandon the ideological system?
>
> Bot3>But the ideology can not adjust to reality. Ideology takes an intellectual system,
>
> User4>What kind?
>
> Bot2>a product of one or more philosophers, and says 'This system must be true'

Fig. 1. Chatbot session with conventional and virtual dialogues

Once the user postulates his opinion, a virtual dialogue is automatically formed from available documents and pages, simulating a conversation between virtual proponents and opponents and virtual bots. The user can read the whole conversation thread, join the discussion he believes are most intriguing, or formulate a question to the thread participant. Given this question, the chatbot takes the user to the part of the virtual discussion thread as close to his question as possible, but with an opposite opinion.

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A persuasion technique for improved verbal communication in people with Parkinson's disease

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1   Introduction

The current study presents preliminary results of a persuasion technique capable of improving verbal communication of people with Parkinson's disease (PD). Based on the proposed method, PD patients can be motivated and trained at their home to talk louder. Although anti-Parkinson drugs and surgical methods are used to treat some of PD's motor symptoms, therapies for speech impairment are not effective. Among PD patients, 70-80% develop speech impairments, such as low speech loudness which can cause loss of communication and results in social isolation. People without PD attempt to increase the intelligibility of their speech by reflex when talking in a noisy environment. This phenomenon is known as the Lombard effect [1]. The current study aims at taking advantage of the Lombard effect to improve speech loudness of PD patients by motivating and training PD patients to listen to masking noise while talking (i.e., listening to noise through headphones), and to design a tool for automatic training. In the [2], the authors demonstrated the experience of the Lombard effect in PD patients. The current study further investigates this issue by analyzing the effect of persistence in louder speech after training under Lombard conditions.

2   Materials and Methods

Six Japanese PD patients participated in the experiments. Their ages were 69--82 years and five of them used a wheelchair while being hospitalized. Each participant sat in front of the laptop at a distance of 50 cm and was instructed to read the utterances displayed on the screen. The experiment consisted of three sessions, as follows:
(a) The patient read the five Japanese vowels without listening to the masking noise.
(b) The patient read 120 short Japanese words while listening to the masking noise through headphones at 70 dB(A) SPL (i.e., training phase).
(c) The patient read the five Japanese vowels without listening to the masking noise (i.e., post-training phase).

3   Results

The results obtained showed that in all the cases, the sound pressure level (SPL) differences without and with the masking sound are statistically significant (i.e., using a two-tailed t-test). Table 1 shows the differences in the SPL of speech for two cases: (a) when there is no masking noise compared with the case when the masking noise is present and (b) without the masking noise before and after the training with the masking noise. As can be seen, when the PD patients listen to the masking noise while talking, the SPL of their speech increases. The results also show that in most of cases (i.e.,

66.7%) the speech SPL after training is higher compared to the speech SPL before training even without masking noise.

Table 1. SPL difference in decibel (dB) before and after training.

Patient	Masking noise vs No masking noise (before training)	No masking noise (after training) vs No masking noise (before training)
F01	+4.7	+1.5
M01	+5.2	-3.3
F02	+6.1	+2.3
F03	+4.5	+1.8
M02	+3.3	-1.1
F04	+5.4	+1.7

4   Conclusions

This study investigated the possibility of using the Lombard effect to increase the speech intensity of PD patients. Previously, a few studies showed that speech intensity of people with Parkinson's disease increases under Lombard conditions. The current study confirms these changes, and in addition, the authors show that the effect of the Lombard effect remains after training patients under Lombard conditions. Based on these observations, the next study will focus on developing speech rehabilitation methods for individuals with PD using data from a larger number of PD patients.

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A Social Credits Platform for Volunteers

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Keywords: Volunteering motives, appreciation, social credits, digital platform.

1   Introduction

In recent years, the former Dutch welfare state has been transformed into a participation society [1]. As support from the government decreases, citizens are increasingly expected to be self-managing. Since not everyone is able to be self-managing, there is an increasing demand for help offered by volunteers. Although the number of volunteers in the Netherlands is relatively stable, the amount of time per volunteer has decreased over the past couple of years [2]. Most volunteers traditionally come from the wealthier, more educated segment of society and are likely to be female, married with children, 50+, and active in religion [3, 4]. In order to meet the increasing demand for volunteers, either the amount of time spent per volunteer should be increased, or new groups of volunteers should be attracted.

The Dutch foundation "Possible Today" started an initiative aimed at motivating (potential) volunteers: Social Credits for Volunteers. This is digital platform, based on block chain technology, connects volunteers with projects. The platform uses a digital currency -Social Credits- to appreciate and reward the efforts of volunteers. The currency can be exchanged for discounts or other value, offered by organizations and stores that feel involved with the community. An important feature of this system is the opportunity for volunteers to draft a social curriculum vitae.

The aim of this study is to generate recommendations for Possible Foundation about how the Social Credits Platform should be designed and deployed in order to persuade (potential) volunteers to spend (more) hours on volunteering. Therefore, the following research question is answered: '*What motives, desires and barriers traditional and less traditional volunteers have in regard to appreciation and reward for volunteering?*'

2   Review of the Literature

Literature [5] shows that volunteering fulfils various kinds of needs, such as social needs, career (job-related benefits), understanding (learning or practicing skills), values (altruistic or humanitarian concern), protective (reducing guilt or escaping personal problems), and enhancement (gaining satisfaction from personal growth). This implies both intrinsic and extrinsic motivation [6]. According to literature [7], extrinsic

rewards, like Social Credits, could undermine intrinsic motivation. Ariely, Bracha and Meier [8] found, besides intrinsic and extrinsic motivation, also image motivation as a drive for prosocial behaviour (including volunteering). This refers to an individual's tendency to be motivated by others' perceptions. The Social Credits system can support both extrinsic and image motivation. Another relevant psychological issue concerns the difference between social norms (applying in social contexts) and market norms (applying in business contexts) [9]. Although we are accustomed to pay for a meal in a restaurant, we do not pay a friend who cooked us dinner at his home. In line with this, people sometimes rather work for free than for a small financial reward because a financial reward is often seen as an indicator of 'what they are worth'. This principle explains the difference between appreciation (social norm) and reward (market norm), and affirms the importance of careful deployment of material rewards.

3 Methods and Results

To answer the research question, 18 semi-structured interviews were conducted with (non-) volunteers from the traditional segment, volunteers with a distance to the labour market (as representatives of the less affluent segment), and students (as representatives of the young segment). The following is a summary of the findings.

Respondents in all segments mentioned 'personal benefit' as the main reason for volunteering. As one of the respondents said: *'It brought back the smile on my face'.* All the aforementioned needs [5] were affirmed in the interviews. This confirms the assumption that volunteering is driven by both intrinsic and extrinsic motivation. As a consequence, the risk of undermining intrinsic motivation by Social Credits can be seen as realistic but not major. Providing volunteers with the opportunity to donate earned credits to charity could reduce this risk significantly.

In all segments 'appropriate content' was a critical factor for volunteering. *'It should fit your expertise and skills'.* Therefore, in order to attract participants, the opportunity to choose the best fitting project from the platform should be stressed.

In all segments 'appreciation' was defined in immaterial terms like 'a smile' or 'a simple thank you', thereby confirming the social context of volunteering. '*It is far more important 'to be seen' than to get material rewards.*' Although this could be explained as social desirability, it is in line with a study [10] in which volunteers preferred intangible over tangible rewards. This seems to confirm the 'social context' of volunteering and affirms that Social Credits should be positioned as a form of appreciation (fitting social norms) rather than as a reward (fitting market norms).

The initial reaction of traditional volunteers and respondents with a distance to the labour market to the Social Credits Platform was reluctant. '*Too much trouble*' and '*invasion of privacy*' were mentioned as objections. In the second instance however, the latter group affirmed to appreciate material 'extras' and mentioned to expect that the platform could increase the status and prestige of volunteering.

So besides focus on transparency (because of concerns about privacy) Possible Foundation should pay attention – in terms of the Unified Theory of Acceptance and Use of Technology [11] to 'ease of use' of the platform and -for the traditional segment- 'perceived usefulness'.

Students mentioned that Social Credits do not outweigh their need for paid work. They were less critical about privacy and more interested in the social curriculum vitae. If this concerns image motivation [8] the amount of earned credits –being an extrinsic reward- should not be mentioned on the social curriculum vitae because for image motivated behaviour, rewards could dilute the signal to others. Finally, students expect that registration on the platform will increase the commitment of volunteers.

Further research, like monitoring a pilot with the platform, should offer more insight in the user experiences of the platform.

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BCD Cards: A Tool for Designing Theory-based Behavior Change Technologies

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Abstract. There is a wealth of theoretical knowledge around behavior change theories and strategies. However due to the lack of accessibility of that knowledge to designers, designing theory-based behavior change technological interventions can be challenging. Card-based design tools can make academic knowledge accessible to designers, providing a structured and creative design process. In this study we present the Behavior Change Design Cards (BCD Cards) - a card deck developed from two behavior change theoretical models, the Transtheoretical Model of Behavior Change and a Taxonomy of 93 Behavior Change Techniques. Through an empirical study, we aim at evaluating the impact of the tool on designers' creativity, their capacity to create theoretically- grounded designs, as well as the perceived usefulness and ease of use of the BCD cards as a supporting tool in the design of behavior change technologies.

Keywords: Design Cards, Behavior Change, Behavior Change Technologies.

1   Introduction

Applying behavior change theory on design practice can be challenging due to the vast amount of theories, models and techniques. Recent surveys have revealed that only limited number of behavior change technologies have used theory in their design process, have implemented behavior change techniques and undergone scientific research [1,2]. Thus, a question arises: how can designers gain access to behavior change literature and therefore design theory-based technological interventions?

Design cards have been a popular design tool, supporting "*knowledge transfer*" (i.e. the translation of research findings from one discipline into another). It has been argued that their simplicity and ease of use can make the design process visible and less abstract, communicate knowledge between the members of a group and increase creativity and idea generation [3].

The goal of this work-in-progress is the development of a card deck named as Behavior Change Design Cards (BCD Cards) based on two behavior change theoretical models, the Transtheoretical Model of Behavior Change (TTM) [4] and a Taxonomy of 93 Behavior Change Techniques (BCTs) [5] with the aim to teach designers the appropriate knowledge when it comes to designing behavior change technologies.

2 Design of the BCD Cards

From the 93 Behavior Change Techniques [5] we chose and combined into categories those that are easy to implement in technological interventions. Each of those techniques was then classified into the five stages of behavior change: pre-contemplation, contemplation, preparation, action, maintenance [4]. Two versions of the BCD Cards were developed for this study's needs. The first version underwent two pilot evaluations with the aim of redeveloping the final tool. The final version of the BCD cards consists of 31 two-sided cardboard cards in total; including, among others, five *stages cards* describing the different stages of behavior change and 23 *techniques cards* describing each of the behavior change techniques (see Figure 1 for an example).
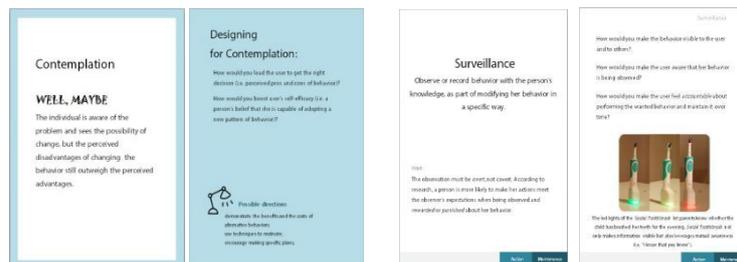
Fig. 1. Two sides of a *Stage card* (Left), Two sides of a *Technique Card* (Right)

Our ongoing work aims at evaluating the impact of the BCD card on designers' creativity, their capacity to create theoretically-grounded designs, as well as the perceived usefulness and ease of use of the BCD cards as a supporting tool in the design of behavior change technologies.

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Data collection explicitness as a micro-suasor: Its effect on sensitivity judgment and safety decisions

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Abstract. It has been found that transparency implemented in the name of the users' safety can instead encourage the users to trust the system and to disclose their personal data. In this work we consider whether the transparency of the data collection technique can work in this way. The study (N = 40) compares an explicit technique (questionnaires) with an implicit one (eye-tracker). The actual sensitivity of the data collected was also varied, sensitive (popularity) vs. non-sensitive (usability). The results suggest that, when judging general data sensitivity, the transparency of the data collection procedure tends to work as a heuristic; this is not the case when more specific judgments or decisions are asked.

1 Introduction

Improving the transparency of a system or service collecting personal data is recommended as a means to increases users' ability to protect their identity and increase their safety (e.g. EU GDPR 2016/679). Paradoxically, however, transparency might backfire: users are reported to take transparency as a cue to quickly decide that a system can be trusted [1, 3] and can then disclose their personal data. Transparency might then work as a micro-suasor [2]. In the present study we focus on the transparency of the data collection technique, comparing an explicit technique (questionnaires) with an implicit one (eye-tracker), and measure its effect on sensitivity judgment (perceived data sensitivity) and safety decisions (waving data anonymity). We also varied the actual sensitivity of the data collected, which was either sensitive (usability) or non-sensitive (popularity). We then had a 2x2 between-participant design. Condition assignment was randomized.

2 Methods

Sample and procedure. 40 university students enrolled in the Psychology School of the University of Padova participated in this study (mean age 23.61, SD = 1.71, men = 9, women = 31). They visited four of their teachers' websites and, according to the study condition, evaluated their usability or popularity via a questionnaire or via an eye tracker detecting their visual behavior. Then they were sent to a Google Form questionnaire asking on 5-point scale: (a) if they consented to *wave the anonymity* of their opinions ("Would you be willing to let us process your data renouncing anonymity, so we can associate your name and surname to the data and responses collected during the whole experiment?") and (b) to *evaluate the perceived sensitivity* of the data provided ("Do you think that the data collected during this experiment is sensitive, namely that it could identify you in a counterproductive manner?"; "Do you think that the information derived from such data could be embarrassing for you?"; "Do you think that the data provided could be offensive to the teachers?"). The whole procedure was automated via Atom software. The informed consent to participate was signed before the session, while the consent to use the data was signed after debriefing.

3 Results

The dependent variables were the frequency with participants accepted to wave the anonymity of their data, and the perceived sensitivity of the data; the values are reported in Figure 1.
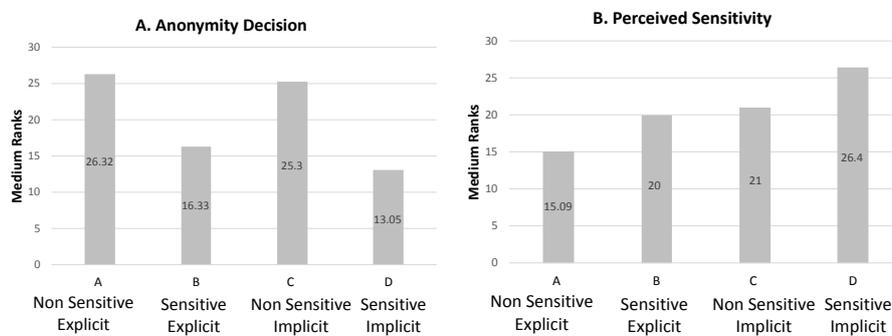
Fig. 1a, 1b. Medium ranks of the willingness to wave anonymity (a, left) and of the perceived sensitivity of the data (b, right) broken down by condition.

To assess the effect of the two manipulated factors (type of data collected and explicitness of the collection technique) a Mann-Whitney test was run (Table 1).

Table 1. Results of the Mann-Whitney test measuring the effects of the two factors, the type of data (usability vs. popularity) and the explicitness of the data collection technique.

	TYPE OF DATA		EXPLICITNESS	
	W	p	W	p
Anonymity decision	311.5	0.002	226.5	0.47
Perceived sensitivity (construct)	145	0.12	136	0.07
Item 1: Generic sensitivity	198	0.97	144	0.08
Item 2: Embarrassment	156	0.10	164	0.17
Item 3: Offensiveness	123	0.01	208	0.81

The results reported in Table 1 suggest that, when judging general data sensitivity (Item1), the explicitness of the data collection procedure tends to work as a heuristic, decreasing the perceived sensitivity of the data regardless of its actual content. Instead, safety decisions such as waving anonymity as well as more specific sensitivity judgments such as the one expressed by Item 3 are more influenced by the actual content of the data. In other words, what can make the difference is the clarity of the scenario in which the user is able to figure the possible risks. This hypothesis will be pursued in further studies and is surely to be taken into account when measuring sensitivity with self-reported methods.

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Decreasing Cognitive Load: Readjustment of UI Workflow from Linear to Modular for a Network of Large-Scale Health Kiosks

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Abstract. User engagement at publicly available health kiosks is typically limited to single or primary task completion. We hypothesize that one limitation to secondary feature engagement is a restrictive UI workflow. higi (www.higi.com), a maker of publicly available health kiosks, currently uses a linear workflow that requires users to make a series of upfront decisions about what features to interact with and does not allow users to change those decisions later in the workflow. With the goal of expanding engagement into sub-primary tasks, a new modular UI was designed that allowed the user to explore features throughout the experience and decrease the cognitive load.

Keywords: Health Technology, Population Health, Kiosk User Interface.

1 Introduction

1.1 Background

higi is a maker of publicly available health kiosks, with a nationwide network of over 10,000 units performing approximately 1 million health screenings a week. The kiosks allow users to measure and track weight, blood pressure pulse and body composition biometrics. All kiosks are connected to higi's cloud infrastructure, which allows users to create accounts, authenticate the sessions, and save their results. Web and mobile application components allow users to track their results over time.

Public mental models for these health kiosks rely on past experiences with blood pressure monitors found in many pharmacies or grocery stores within the Unites States. These kiosks dominated the landscape long before the entry of the internet or connected devices. It is important to view the higi kiosks within this paradigm as the average age of a user is 46.3 years. This history encourages a mental model where the higi stations are used only to measure blood pressure without realizing the value of other features.

1.2 Existing UI Workflow

The current kiosk user interface (KUI) allows users to make an upfront test selection. After completion, most users leave the kiosk unaware of the value of other features.

Fig. 1. A common workflow experience on the current KUI.

2 New KUI

2.1 Hypothesis

We hypothesize the antiquated mental model produces high cognitive load when a user is forced to choose a single option among many unfamiliar options at the beginning of the experience. We are testing that once the intended task is completed the load is lifted and the user will explore other options, updating their mental model.

2.2 Proposed Solution

Our solution is to allow the user to make a feature selection at any time in the workflow. This allows the user to quickly select and take a blood pressure test and presents the results in the context of other features with which the user has not engaged.
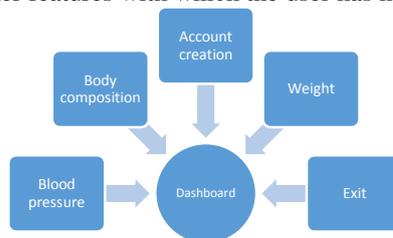
Figure 2 Updated KUI where each feature returns to a dashboard showing all features.

2.3 Anticipated Outcomes

Formative user testing indicates that users would also like to explore other features, including measuring body composition and weight. We expect these behaviors to continue once the new KUI is released across the kiosk network and will report on them, should they be available at the time of presentation.

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Developing a system for prevention of metabolic syndrome

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Abstract. The aim of this presentation is to explain how a behaviour change support system has been developed, what were its core features, how users perceived those features and whether it succeeded to produce desired health outcomes.

Keywords: Behavior change support systems, PSD, outcome, user experience

1   Introduction

Despite promising results of digital health interventions, there is insufficient understanding of why some interventions succeed and some do not work.

2   Background

This study is part of a large ongoing research project called PrevMetSyn addressing working-age overweight or obese people (BMI 27–40) who are at risk of developing or have already developed metabolic syndrome. A randomized controlled trial for 52-week lifestyle intervention with different types of counselling with and without information system support has been carried out.

Persuasive Systems Design (PSD) model [1] and Behaviour Change Support Systems (BCSS) framework [2] provided systematic methods to develop a web information system for this purpose. The information content was based on cognitive-behavioural theories seeking to educate users to identify and cope with dysfunctional thoughts interfering with their behavioural goals and self-efficacy beliefs. Healthcare professionals with extensive experience in guiding people in lifestyle changes provided the content used in the system.

This presentation addresses the design science effort for developing the system and mixed methods research for evaluating the design. The latter is based on interpretive interview analysis of user experiences based on 43 users [3, 4] and quantitative analysis of the health outcomes of 259 users [5].

3   Results

When designing the target system, a careful analysis of the Persuasion context, including the Intent (who actually is the Persuader, what is the Intended Outcome/Change, and what is the Designer bias), the Event (User, User and Technology context) and the Strategy (Message and Route) for persuasion was carried out. The key persuasive features finally implemented into the system consisted of self-monitoring, reduction, tunnelling and tailoring for Primary Task support; reminders, praise, suggestion and liking for Computer-Human Dialogue support; verifiability for Credibility support; and social learning and social facilitation for Social support.

In the user experience study, self-monitoring, reminders, and tunnelling were perceived as especially beneficial persuasive features. The need for social support appeared to grow along the duration of the intervention. Unobtrusiveness was found to be very important in all stages of the intervention. In the RCT with one-year and two-year follow-ups, it was found that the designed system had a major impact on weight loss and on waist circumference, the main criterions of the metabolic syndrome. The other components of metabolic syndrome, such as blood pressure, plasma triglycerides, HDL cholesterol and fasting glucose, were also slightly improved by the designed system.

4   Conclusion

The design effort and randomized controlled trial shows that health behaviour change support systems can affect individuals' health behaviours. In general, explanation of what has been implemented in the designed system and how, is critically important for advancing the science into digital health behaviour change. The PSD model and the BCSS framework provide systematic and effective support for the design and development of such interventions.

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Development of a prototype persuasive virtual reality training to support the prevention of surgical site infections

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1 Background

A surgical site infection (SSI) is a serious nosocomial infection of a surgical wound that occurs within 30 days after surgery [1]. SSIs can cause unnecessary pain, fear and inconvenience for the patient and may lead to longer hospitalization, permanent disability or even death. To prevent SSIs and to maintain a patient's safety, guidelines are applied before, during and after surgery. These guidelines include hygiene measures (such as hand hygiene, wearing clothes correctly, limiting the number of door openings), antibiotic prophylaxis (administering antibiotics in the right dose at the right time), hair removal, and maintaining the patient's body temperature during surgery [2]. However, compliance with these guidelines seems to be problematic due to i.e. a lack of awareness about risky situations and difficulties in signaling mistakes within the hierarchical work environment [3]. Virtual reality (VR) as a training approach has the potential to address these determinants due to its focus on both cognitive (situation awareness) and affective components (mindset) [4]. Building upon earlier research [3], this study aimed to translate relevant determinants into an initial VR training prototype to support operating room (OR) staff in preventing SSIs by fostering situation awareness and reducing signaling fatigue.

2 Method

Following the design phase of the CeHRes Roadmap [5] for the holistic development of eHealth technology, a focus group (n=5) among OR staff was conducted in order to transform determinants into concrete and realistic situations that can be translated into VR-scenarios. Participants were instructed to 1) provide anecdotes about risky situations related to one of the determinants, 2) rank them according to prevalence and infection risk and 3) describe the highest ranked situations as detailed as possible ("*What do you see, do, say, hear, think and feel?*"). The meeting was audiotaped and transcribed verbatim. The in-depth information was then used to create a film script that contained different (risky) situations in the OR and served as the basis for VR-video production. Filming took place in a simulated OR starring an OR team consisting of an experienced surgeon, anesthesiologist and OR nurse, and two medical students acting

as OR nurse and anesthesia assistant. Finally, training instructions were built around the videos based on requirements resulting from earlier research [3].

3   Results

Findings resulted into an initial VR training prototype consisting of 1) a serious VR game centered around risk recognition to increase situation awareness, and 2) a module addressing signaling fatigue in the OR and promoting an open dialogue culture. The VR game contains five scenes distributed across the pre-, peri- and postoperative phase of a knee operation (preparing in changing room, handwashing and disinfection, time-out procedure, performing the operation and wound closure). While immersed into the OR environment, users are challenged to detect 18 risk situations in total, with a varying degree of difficulty. Scores on individual and group level are visualized in an improvement plot that should serve as input for team debriefings. Within the second module users can follow a surgeon unintentionally putting the patient at risk and different kinds of reactions (sub-assertive, assertive, aggressive) to a critical remark from an OR assistant. Different tailored follow-up questions are posed focused on self-reflection, correcting irrational thoughts and stimulating discussion within the team with the goal of fostering an open dialogue culture.

4   Conclusion

The follow-up focus group provided valuable and detailed scenarios regarding risky situations in the OR that could be translated into an initial VR training prototype. Future steps will be directed at iterative testing of the prototype among users in the Netherlands and Germany, improving persuasiveness and exploring how the training can be embedded into an eLearning platform aimed at increasing the compliance of OR staff with best practices for the prevention of surgical site infections.

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Exploring Gamification and Ambient Technology to Support Students' Physical Activity in Between Lectures

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Abstract. This poster presents an interaction design project investigating how to encourage students to more physical activity in between lectures using persuasive technology. We combined an ambient display with gamification elements, to create an interactive in-class prototype. The prototype, a digital flower, acts as a mirror of students' wellbeing. Withering slowly during lecture time, the flower is in need of nutrition that students can collect during breaks. Early findings indicate that students positively engage with the prototype, they are motivated to move and find nutrition during breaks, and they collaborate when doing so. We describe our design and our prototyping process, exploring persuasive design using ambient technology.

Keywords: Gamification; Ambient Display; Behavioral Change.

1   Introduction

Physical activity can help students to focus and stay on task. A recent study [1] found that interspersing lessons with 20-minute bouts of aerobics-style exercise improved the attention spans of school children. Unfortunately, we discovered from a three-day observation study at our university college that many students stay seated in classrooms during breaks. The goal of our project was to design digital technology that motivates students to leave the classroom for physical activity and fresh air to improve their performance during lectures. There is a substantial body of work on persuasive technology and physical activity. Both the use of aesthetic pleasing properties [2] and gamified approaches [3] when designing persuasive technology has been shown beneficial for motivation and behavior change. In the following we report on how we used ambient technology and gamification to create an interactive in-class prototype to support students' physical activity in between lectures.

2 Design Process

Based on previous research we decided to create a prototype that is part of the classroom to provide ambient awareness of students' wellbeing. Through the gaming interface we aimed to support students to work together, promoting physical activity as social experience. The designed prototype is an interactive tangible flower, with an emoji display reflecting students' tiredness throughout the day. By shifting from a happy face to a sad looking face we provoke students' emotions and raise awareness about their own wellbeing. The flower prototype is based on an Arduino micro controller. To make the flower happy again, students need to collect nutrients around the college. The nutrients are colorful 3D printed marbles containing a Near Field Communication (NFC) tag. Students feed the flower by pouring the nutrients in the flower vase, which registers them using an integrated NFC reader. During the design process we created two prototypes: a video prototype [4] exploring the role [5] of the artifact in the classroom, and an interactive prototype (Fig. 1) to evaluate the look & feel [5] of the artifact.

Fig. 1. The interactive flower prototype

Early findings from a pilot test during two classes indicate that students positively engage with the prototype, they are motivated to move and find nutrition during breaks, and they collaborate when doing so. We plan to evaluate the prototype over a longer period of time during the upcoming semester.

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Gamification as Reward Provision

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Abstract. The positive effects of gamification on users' engagement, pleasure and motivation with interactive technology has been repeatedly highlighted. However, while gamification is pervasively used by designers, at the time there is a limited understanding of how to best design gamified systems, as there is a lack of empirical support. Two theoretical frameworks, Behavioral Psychology and Cognitive Evaluation Theory can work as lenses in order to develop a new empirically supported design framework of reward provision. Each dimension of reward provision, proposed by these two theories, have different effects on individuals' behaviors. In this paper, we present our ongoing work aimed at developing a design framework, focusing on the *what*, *when* and *how* of reward provision in order to guide the design of gamified systems.

Keywords: Gamification, Behavioral Psychology, Cognitive Evaluation Theory

1   Introduction & Background

Gamification has seen a spike of interest both in research and practice. Empirical findings have confirmed the positive impact gamification has on individuals' motivation to perform given activities [1], most often through making the activity joyful or through addressing core psychological human needs [2]. However, while gamification is pervasive in digital products and services, at the same time there is a limited understanding of how to best design gamified systems [3]. With a number of studies reporting that users often abandon smart devices after a couple of months of use [4], designing for sustained use becomes a pressing challenge.

1.1   Behavioral Psychology

Behaviorists have proven that rewarding consequences can influence the desirable behavior to occur again in the future [5]. They have found that different reward schedules – rules about timing of reward provision - can influence differently the speed of learning and the maintenance of the new behavior [5]. Schedules of rewards can be either continuous or partial. In continuous schedule, the desirable behavior is reinforced every time it occurs. On the contrary, partial reinforcement does not reward each time the behavior occurs. There are two types of partial reinforcement: ratio, where a reward is provided after N executions of behavior, and interval, where a reward is provided after a specific period of time on the condition that at least one execution of the behavior has occurred during that period. Ratio and interval schedules are further split into fixed and variable.

1.2   Cognitive Evaluation Theory

Cognitive Evaluation Theory examines how extrinsic rewards can influence the intrinsic motivation of humans and specifically the internal process of reward provision [6]. Researchers have found out that the motivation of humans can be affected differently based on three different dimensions: The reward type, in which the reward can be intangible or tangible, the reward contingency which is divided into four subcategories -performance, completion, engagement and task -noncontingent rewards- and the reward expectancy in which the reward can be expected or unexpected.

2   Conclusion and Ongoing Work

While gamification is pervasively used by designers [7], work so far has not exploited the dimensions which have been proposed by these theories as an empirical lens for the design of gamification, while we have evidence of weak efficiency of using gamification [3]. Since there is ample evidence that the above dimensions of reward provision impact individual behaviors, we suggest that this knowledge can be leveraged for the design of gamified systems. Our ongoing work focuses on uncovering the design space of reward systems through a systematic review and finally make this knowledge accessible in design teams.

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Gender Differences in the Perception of Gamification Elements for Fitness Systems

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Abstract. In this paper, we present results from a storyboards-based study (N=178) to assess gender differences in the perception of gamification elements for persuasive fitness systems. We found that females prefer personalized goals and collecting points, while males perceived the persuasiveness of competition and cheating as significantly higher. Our results could be used to tailor gamified, persuasive fitness systems.

Keywords: Personalization · Gamification · Physical Activity

1   Introduction, Related Work, and Method

Persuasive systems have been developed using gamification to motivate people being more active in daily life [2]. While such systems often incorporate a "one- size-fits-all" approach, research has shown that tailoring gamification elements is important [7] and appreciated [4]. More specifically, factors like personality, age, player types and also gender have been shown to have an influence on the perception of persuasive strategies [1]. For gender, Orji [5] has found that the perception of persuasive strategies indeed differs between male and female participants in the domain of healthy eating. Also, Koivisto et al. [3] found that women report greater social benefits from the use of gamification within Fitocracy (an exercise gamification application). Furthermore, Tondello et al. [6] report gender differences in the perception of gamification elements in a general context, e.g. that social elements are preferred by men. However, in this paper, we focus on the physical activity domain (instead of a general context) and consider individual gamification elements (as defined by Tondello et al. [7]), instead of persuasive strategies. We set-up an online questionnaire to assess the perceived persuasiveness (7-point Likert scale) of 12 gamification elements (**Vir**tual Character, **Bad**ge, **Cha**llenge, **Che**ating, **Cus**tom Goals, **Per**sonalized Goals, **Kno**wledge Sharing, **Poi**nts, **Rew**ards, **Col**laboration and **Com**petition), illustrated by a validated storyboard each [1].

2   Results

We received 178 valid responses (44.4% male, 55.6% female). Using an independent t-test, we found significant differences for the gamification elements "Cheating", "Personalized Goals", "Points" and "Social Competition" with medium to large effect sizes. While male participants like the gamification elements "Cheating" and "Competition" significantly more than women, females show a clear preference for "Personalized Goals" and collecting "Points". Figure 1 illustrates the mean scores for each gamification element and both genders as well as effect sizes, in case a significant difference was found. Our results could be used to personalize gamified, persuasive fitness systems, when information about the gender of a user is available. As far as we know, we provide the first investigation of gender differences for gamification elements in the fitness domain.
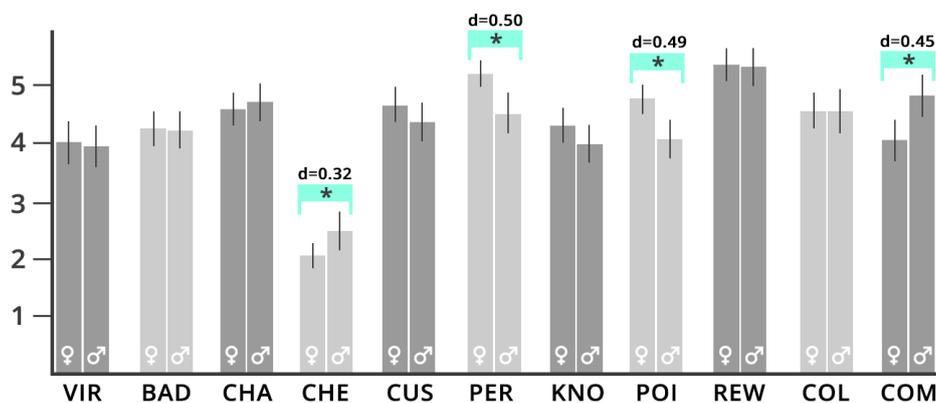
Fig. 1. Mean perceived persuasiveness (7-point scale), error bars, significance and effect sizes (d) for each gamification element and both genders. * p<0.05

3   Limitations

We used storyboards instead of implementing gamification elements and considered only male and female genders. Future work should account for the increasing gender diversity as well as consider real implementations.

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Guiding Health-Related Behavior of the Aging Population

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1   Introduction

Physical activity is vital to a healthy life. It is associated with a decreased chance of developing diabetes type II, cardiovascular diseases, various forms of cancer and depression. Furthermore, it can prolong the ability of older adults to live independently. Community-based programs typically offer weekly group exercises for older adults led by an instructor. Exercising once a week, however, is not enough to achieve health benefits. Furthermore, the possibilities to accommodate individual differences in a group-based program are limited. In contrast, home-based exercises can be tailored to individual needs, but lack guidance.

To support older adults in performing safely home-based exercise a blended intervention was developed. It combined a tablet application and e-coaching. The

intervention was designed to facilitate behavior change. Older adults could use the tablet for goal setting, tailoring a training schedule or evaluating progress with a personal coach [1].

2 Methods and Results

A pilot study showed that older adults were able to operate the tablet in an effective and efficient manner [2]. A follow-up clustered randomized controlled trial was conducted to assess the long-term effects [3]. The study included 224 older adults (>55 years) who either participated for six months only in weekly community-based group exercises (control) or an additional program with home- based exercises that was supported by the tablet and e-coaching. Before and after the six months intervention period the physical activity levels of the participants were measured with a combination of a wearable accelerometer sensor and a diary that described their activities over the past three days. Furthermore, the daily use of the tablet was tracked during the six months intervention.

Results show that older adults that participated in the additional home-based exercise program achieved significant higher physical activity levels than control participants who only followed the weekly group exercises. Using persuasive technology to increase physical activity levels in the ageing population appears to be a viable approach.

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How Would You Like Your Tech?
Personas for Perfectly Cooked eHealth
Technology

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1   Introduction

By engaging with personas, developers and researchers can be reminded of their target group. Personas exemplify fictive members of the target group and consist of a description of these potential users. In eHealth projects, health-related attributes form an important part of the personas: what specific health-related activities do the prospective end-users (have to) undertake? Do they have difficulties doing this, and what is already going well? Such questions represent factors that can be used to paint the "end-user picture". LeRouge et al. developed a conceptual model for identifying significant health-related user profile and persona attributes from qualitative data [1]. However, user characteristics reaching beyond health factors may lead to more enriched personas that accommodate to the different types of users instead of patients [2]. Holden et al. elaborated on these views by using a quantitative cluster analysis on biopsychosocial survey data [3]. As a downside, such a quantitative cluster analysis may require additional quantitative data collection, while qualitative data containing comparable information is often already available during user studies. Therefore, we expand on the previous approaches by using qualitative data we typically collect during user studies, moving beyond health-related data and (also) focusing on technology-related data. We hope to learn how to attune technological features to our user. This can stimulate developers, designers and researchers to better understand how persuasive technological interventions can be designed to support user needs, ability, and preferences and predict use.

2   Method

In this study, personas will be developed for technology to empower people with cardiovascular diseases (CVD) in maintaining a healthy lifestyle. First, experiences in living with CVD, technology use and trust, and motivation were extracted from interviews with participants (n=25) conducted a pilot study to evaluate the feasibility of a CVD telemonitoring system [4]. Interviews were analysed to identify themes and

variations to feed the cluster analysis. Two independent coders (JW, FS) analysed the interviews based on a predefined coding scheme based on the conceptual model of LeRouge [1], supplemented with existing literature describing CVD populations. All resulting themes and variations were categorized into binary variables to enable cluster analysis. Furthermore, quantitative data regarding the use of the telemonitoring system, demographics, eHealth skills and quality of life (EQ5D) was used for the cluster analysis. A hierarchical cluster analysis will be carried out on the qualitative data combined with the binary variables derived from qualitative data (work in progress). The identified clusters will be compared by carrying out comparative, non-parametric statistical tests on the distinct variables of each cluster. Based on the outcomes of these statistical tests, hypotheses can be formulated about which variables are of added value for creating eHealth personas.

3 Results

Currently, the analysis of interview data is finalized. Themes emerging from the secondary qualitative analysis, including 'previous technology use' and 'attitude towards eHealth technology' will be used in the cluster analysis. The most predictive or influential variables of a cluster will be included in the personas. The resulting personas will be used to select (persuasive) technology features to be included in the design. The personas will be used to profile participants and tailor future interventions to the needs of the different user profiles. This way, the predictive and design choice-leading value of the personas can be assessed. For the conference, we are particularly interested in learning other scholars' opinions on how to mature the model, re-evaluate the personas based on actual use, and how to expand it to different target groups.

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On The Design of The Nudge Deck

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Abstract. Over the past 10 years, research has explored subtle changes in the environment that can alter people's behaviors in a predictable way. These small changes, so-called *nudges*, offer an effective way to influence peoples' behavior without restricting their freedom of choice. Yet, while a wealth of nudges have been developed and studied over the years in Human-Computer Interaction literature, little guidance is available for researchers during the design process. This paper presents the *Nudge Deck*, a design tool that support researchers during the concept generation phase by increasing researchers' ability to access and employ behavioral economics knowledge. The deck illustrates 23 different nudging mechanisms, all of whom are complemented with questions and hints, which aim to inspire the design process, incite discussion and support design choices. In this paper, we report on our current and future work.

Keywords: Design Cards, Nudging Mechanisms, Persuasive Technologies.

1   Introduction

Over the past ten years, HCI researchers have explored ways to "nudge" users towards desirable behaviors. Yet, even though there is plenty of information about nudging interventions, there is little design guidance in setting up a concrete, detailed intervention that can be tested empirically [2]. In this paper we describe the development of a design support tool – a deck of design cards - for technology-mediated nudging.

2   Design of The Nudge Deck

The *Nudge Deck* illustrates 23 different nudge mechanisms clustered in 6 comprehensive categories: *Facilitate*, *Confront*, *Deceive*, *Social Influence*, *Fear* and *Reinforce* [5], each of them represented by a different color (see Fig. 1).

Fig. 1. Card example: The "Suggesting Alternatives" mechanism explains the concept on the front, while on the back guidelines are explained. On the right, five categories are shown.

The front of the cards encloses the definition of the nudging mechanism followed by an image of a possible implementation and a short explanation. To discern the situation in which each nudge should be used, the 23 mechanisms were mapped into the three types of triggers suggested by Fogg's Behavior Model: *sparks* (i.e., ones to increase motivation), *facilitators* (i.e., ones that increase ability) or *signals* (i.e., ones to remind of the behavior), which are represented in the bottom of the card in the form of an icon (see 1.b). The back side of the cards displays guidelines, questions and hints to assist the initiation and propagation of individuals' thought during the design conception.

Moreover, as far as the evaluation of the cards is concerned, 3 pilot studies are planned and future work will aim at assessing their effectiveness in supporting the design of technology-mediated nudges. We will examine the perceived usefulness, ability to spark creativity, discussion and efficiency in transferring theoretical knowledge in the design process.

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Preliminary study on the use of behaviour change for distracted mobile phone users

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1   Introduction

Many studies exist on the dangers of using a phone while driving, walking or cycling but laws against it are often ignored. According to [2] in the US from 2004 to 2010 there was an upwards trend of pedestrian injuries from phone use. In Tokyo, from 2010 to 2014, 152 injured while on a phone walking or   on a bicycle [1]. While some collision and avoidance solutions for phones have been done, these only reinforce phone overuse attitudes and serve as temporary solutions. Alternative approaches to change the underlying behaviour are needed. Oinas-Kukkonen et al. present a behaviour change support systems (BCSS) and persuasive systems design (PSD) model with guides on how to change people's attitudes or behaviour [3]. Our goal is to use the O/C matrix to change the thinking of a phone user, so that they themselves understand their phone overuse.

2   Method

Our initial approach is to conduct a quantitative survey to find out use cases of the phone and user profiles. Based on the survey data we use matching persuasive methods from the profiles e.g. competitiveness for gamers. A long/term behaviour change uses outcome/change matrix by 'altering an attitude' A/A and/or behaviour, and then 'reinforce an attitude' with R/A. We assume switching user's focus away from phones to something positive, e.g. encouragement and social status boost might have better success than coercion by law.

3   Preliminary Survey and Conclusion

We conducted a small survey (N=22) to get a rough understanding on reasons and justifications of walking use, and asked preferences on the PSD model's social principles [4] which might motivate walking use reduction. Surprisingly 81,7% used a phone while walking, and the three most used functions were texting 26,3%, browsing 21,1% and social networking services (SNS) 15,8%. The main reason was a perceived convenience (40%) of the phone and its applications which was justified as not being seen as "an inconvenience to others" (38,1%). Second," having important tasks that cannot wait" (28,6%) overruled concern for others. However, as seen in Fig. 1 walking use is seen as slightly negative by 'others' and even by walking users themselves.
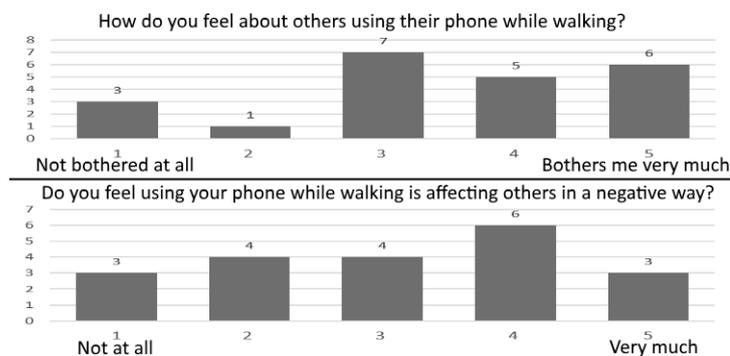
Fig. 1. Perceptions of using a phone while walking from users (N=20) and others

The answers for the seven social principles, leaned towards using behaviour change through 1) comparing phone use performance of others (68,2%), 2) competing against each other (54,5%) and 3) cooperating in a group to reduce phone use (45,5%) which correlates to human's natural instinct to cooperate or compete. We also inquired intentionally coercive and incentive suggestions for legal, functional and social features for walking use reduction. As expected, the majority preferred beneficial incentives such as discounts, instead of coercion like monetary fines. This gives credence for BCSS use, if the incentives are perceived advantageous. But, the convenience of the phone in everyday life is a big factor and thus difficult to change. Initial per- suasion could start when users are stationary, by sharing walking use statistics, giving badges for good performance, and later, gradually giving notifications or reminders while walking, when the user is acceptive. Walking use can also be accidental so small reminders might be effective. In this pilot study, the high number of walking phone users was due to counting every instance of walking use. For this reason alone, sweeping conclusions cannot be made. A thorough qualitative survey with categorized use cases, while measuring total walking use times and phone lift count, are needed.

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Promo@Work: Evidence-based Health Promotion in Workplaces

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1　The Project

Promo@Work is a collaboration research project, which is funded by the Strategic Research Council at the Academy of Finland. The collaborating parties are the Finnish Institute of Occupational Health, university of Oulu, university of Tampere and university of Cologne.

The aims of the project are 1) to produce evidence-based knowledge and information about the effects of healthy living regarding recovery from work-related strain and stress; and 2) to research the effectivity and utilization of persuasive technology regarding the promotion of health and well-being in workplaces.

In the project, a mobile application for helping entrepreneurs to recover from work was developed with the help of Persuasive Systems Design (PSD) [1] model. An intervention was realized in the form of a randomized controlled trial. Micro-entrepreneurs were recruited as participants for the eight-week intervention.

2　Background

Underlying Theories. The PSD model [1] was used as the framework for designing the persuasive technology features within the application, whereas the Self-determination theory (SDT) [2] was used as the theoretical background. The Transtheoretical Model (TTM) [3] was adopted for 'Stages of Change'-driven goal setting within the application.

Health Problem Domains. The following health problem domains were included within the application: 1) Exercising, 2) Stress management, 3) Efficient working hours (time management), 4) Recovery from work, 5) Sleep, 6) Nutrition (dietary) 7) Sedentary behavior (excessive sitting). Alcohol consumption was integrated within the health problem domains and therefore was not a standalone domain within the application.

3   The System

Primary Task Support. The application utilized two different PSD principles from the Primary task support category: Self-monitoring tools e.g. pedometer for providing the users ways to track their performance or status; and Rehearsals e.g. nutrition rhythm tool for rehearsing target behavior.

Dialogue Support. From the Dialogue support category, four different PSD principles were utilized in the app. Praise was used for giving the users feedback on their positive behaviors; whereas Reminders e.g. push notifications were used for reminding the users of their target behavior. The users were suggested to carry out certain behaviors during the usage process. The visual side of the system was designed to be attractive; therefore, the users should like the look and feel of the system.

System Credibility Support. The application could have said to utilize one PSD principle from the System credibility support category. As the system provided evidence-based health promotion, it could be viewed as trustworthy.

Social Support. From Social support category, one PSD principle was present in the application: Social comparison e.g. stress statistics tool for providing the users means for comparing their situation with the situation of others.

4   Project Status

The system was built mainly during 2017, and released for the intervention group participants in March of 2018, marking the beginning of the eight-week randomized controlled trial period. The control group participants gained access to the app during September of 2018. As of 2019, the results will be analyzed and published.

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The development process of the *One Health Hub*: a persuasive eHealth platform to support cross-sectoral collaboration to prevent and control zoonosis outbreaks

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1   Background

Zoonotic diseases encompass a large part of all infectious disease. Dealing with these zoonotic infections can be quite complicated and requires cross-sectoral collaboration between human, animal and environmental health sectors [1]. This complexity is mainly caused by (1) the involvement of many stakeholders with diverse interests, (2) the impact on societal and economic level and (3) unclearness about the solution. To deal with this complexity, the One Health approach must be applied, wherein these multiple sectors collaborate in order to achieve better public health outcomes [2]. However based on earlier zoonotic infectious outbreaks, it is safe to say that such cross-sectoral collaboration can be improved [1]. This study aims to contribute to combating emerging and re-emerging zoonosis outbreaks through the development of a persuasive eHealth tool, the *One Health Hub* (OHH). The OHH (1) supports collaboration between sectors by providing a serious game for professionals to coach multidisciplinary decision-making during outbreaks and (2) offers an interactive tailored Q&A system for both professionals and general public. The development process of the OHH (as described in this paper) followed the CeHRes Roadmap, making use of participatory development, persuasive design and business modeling [3].

2   Method

Following a mixed-methods user centered design approach, different methods were used during the development of both the OHH website and the serious game, such as focus groups (n=17), interviews (n=26), online cart sort study (n=53), usability tests (n=20), content validations (n=24). During this process, think-aloud protocols, low-fidelity, high-fidelity prototypes and scenario-based tasks were used to help participants to envision their wants and needs for the technology. The involved stakeholders were selected based on the stakeholder identification study (n=36 key-stakeholders) representing the human, animal and public health sectors [4]. Besides key-stakeholders, experts in persuasive technology and general public also participated in this study. All

interviews, focus groups and usability tests are transcribed verbatim and open coding was applied for analysis.

3 Results

Serious game: The game is evaluated in multiple stages of development by potential end-users and experts. According to the results, features of every category of the PSD model are required. One test was conducted wherein all non-player characters (NPC) were evaluated by their real-life characters (e.g. the NPC poultry farmer was evaluated by a real-life poultry farmer) in order to achieve real-world feel, personalization/simulation and recognition within the game. The results showed inaccuracies in the story-line of the game-scenario, which was then re-written accordingly. Also, the scoring system, in-game and end-game feedback had to be re-designed in some respects, so that praise, rewards and social learning better fitted the potential end-users. *Interactive tailored Q&A system:* As results from the interviews and usability tests, the system was designed by tailoring and tunneling the provided information separately for professionals respectively general public. Additionally, it was considered a prerequisite that the information is accurate and written in language level B1 (Dutch language classification). Usability tests showed that searching for and finding the right information was found challenging. Therefore, a smart chatbot (dialogue support) which interacts with the user and guides him/her through the website was embedded in the system.

4 Conclusion

All findings from the iterative formative evaluation cycles with stakeholders were used for the development process. Stakeholders started with formulating their fundamental values. These then led, via low- and high-fidelity prototypes to the eventual persuasive product: the *One Health Hub*. Future steps will be (1) to expand the functionalities of the OHH, to make sure it also incorporates social support via a networking option and (2) to successfully implement the OHH. Furthermore, the effectiveness of the OHH will be studied by a summative evaluation.

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Unobtrusive sensing technologies to monitor and coach elderly with dementia: Track, Trace & Trigger

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1   Background

Due to an increasing aged population creating immense rises in health expenditure and residential care costs, the number of people living independently with dementia will increase significantly in the coming decades [1]. To facilitate extended independent living of people with dementia researchers investigated potential solutions such as smart homes that involve the use of sensors coupled with algorithms to detect deviant use of home equipment or falls [2].While these are important areas of research, there is also a need to provide solutions for monitoring of and caring for behavioural symptoms and emotional wellbeing of elderly with dementia. Patients in the early stage often face emotional disturbances like anxiety, apathy or depression whereas in moderate stages behavioural problems like agitation and sleep disorders are a common feature [3]. However, current monitoring devices for behaviour and emotion like cameras or wearables are obtrusive, making elderly feel uncomfortable, and are sensitive to privacy breaching [2]. Our current project therefore centers around the development of a novel, unobtrusive Wi-Fi-disturbance- and acoustic-based sensing system designed to automatically annotate behaviour and emotion of elderly with dementia, connected to a persuasive care platform for caregivers to provide valuable information regarding daily functioning and behavioural and emotional state. Moreover, we assess how these monitoring data can be used to initiate certain acoustic cues (automatically, in the right moment) to trigger behaviour or induce relaxation and wellbeing in elderly with dementia. We apply a multimethod participatory development process that is used to create fundamental knowledge building blocks.

2   Approach

To realize a good fit between technology, context and stakeholders the project applies the first three phases of the CeHRes Roadmap [4] for the holistic development of eHealth technology, combining value-based design and persuasive technology.

Contextual inquiry and value specification: The main goals of the contextual inquiry are to provide an overview of the current situation, its issues and relevant stakeholders. Multiple methods are used including a literature review investigating behavioural and emotional parameters in dementia, desk research to identify relevant stakeholders, and interviews with formal and informal caregivers to identify needs and expectations of technology with respect to behaviour and emotion of elderly with dementia. Within the value specification, focus groups with experts in the field are organized to explore values towards unobtrusive monitoring at home including privacy and ethical issues. A value map will be created using the Analytic Hierarchy Process [5], a multi-criteria value-ranking method. Results from contextual inquiry and value specification will be translated into system- and service requirements.

Design unobtrusive sensing system: The design stage centers around how to generate valuable data and transfer them to caregivers via our care platform in a user-friendly and persuasive way. The system which analyzes motion, speech features and physiological data will be trained in experimental set-ups involving test subjects both with (ecological setting) and without dementia (lab-setting). Machine learning techniques are applied in order to improve accuracy in annotating behaviour and emotion.

Design acoustic trigger system and framework: Identified requirements will be used to develop a data-driven persuasive trigger system which prompts acoustic triggers based on the behavioural and emotional state of the patient. We involve both patients and caregivers for studying the feasibility of this unobtrusive coaching strategy. In a last step, the input from all phases will be used to develop a toolkit for unobtrusive monitoring and coaching that optimizes ageing in place, reduces the burden of care and positively influences wellbeing of people with dementia.

3   Current progress

The project currently is in the contextual inquiry phase. The preliminary focus of the monitoring system has been determined based on literature and expert advice. Besides, different interview studies with formal and informal caregivers of people with dementia are started based on gathering fundamental knowledge about needs and expectations of unobtrusive sensing technology that will result into system- and service requirements. Preliminary results will be presented.

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Value Sensitive Analysis of a Persuasive System for Breastfeeding

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Abstract. Although the obvious iniquities, namely coercion, deception, and manipulation, are not part of persuasive technology philosophy, the developers have to deal with ethical challenges when designing persuasive systems. To study how potential ethical issues could be dealt with already during the design process, we took a closer look to a persuasive system with highly sensitive topic. We conducted both persuasive system design analysis and value sensitive analysis to comprehend the system and the contextual issues related to it. Our study revealed, that value sensitive analysis can benefit persuasive system design process by providing new and valuable information for the designers. In the end, the new information can help making the system more ethical, but also more valuable and thus persuasive for the users.

Keywords: Value sensitive analysis, Ethical analysis, Persuasive systems

1   Introduction

Ethical questions often arise when developing persuasive systems [1]. Depending on the case, the issues faced with can vary remarkably and no single means exists to resolve all possible issues in an easy manner [2]. Persuasive Systems Design (PSD) model [1] has been created to help designing persuasive systems, but it only provides partial support for analyzing ethical issues. In our study, we investigated whether Value Sensitive Analysis [3] used together with PSD model could help better address the ethical issues. More specifically, we were interested in what kind of information stakeholder and value identification could provide, and how they could benefit persuasive system design. A longer version of this study can be found in [4].

2   The case

We utilized a mobile application called Milky Way to study the research problem. The Milky Way application was developed by University of Wollongong's researchers. The application was designed based on lessons learned in a research project, whose goal was to educate and support mothers with breastfeeding from early pregnancy to postpartum period. In the project, the breastfeeding information was given in the form of face to face educational sessions before and follow-up support telephone consultations after giving birth [5]. The Milky Way Program increased the likelihood

of breastfeed [5]. The application was developed in order to test whether a mobile application is a feasible mean to deliver such program successfully.

3   Analyses

First, we conducted a PSD analysis to form a detailed picture of the Milky Way application. As a result, we had a clear picture of the intent, the event, and the strategy of the application, as well as a list of persuasive software features utilized in the Milky Way.

The VSA produced a list of relevant stakeholders. In addition to the obvious, such as the women with intent to breastfeed as end users, the VSA produced a list of other relevant stakeholders, such as numerous health care advocates and university personnel (see more from [4]). Naturally, the importance of different stakeholders varied. VSA also produced a list of relevant values together with explanations in the context.

4   Conclusion

The VSA produced relevant and useful information for persuasive system design. By identifying the relevant values of the identified stakeholders, the persuasive systems will be potentially more ethical, since some of the ethical problems can be resolved during the design phase. In addition, the found values can be utilized as guidelines for the system design.

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Walking Activity for Sedentary Office Workers by Walking Event Using Mobile APP

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1   Introduction

Walking is an easy exercise and has been recognized as one of the health maintenance activities for the prevention of lifestyle diseases [3], and walking events are considered to promote walking activity in participants. However, in such events, mostly people with high health consciousness and those who walk regularly tend to join in. According to [1], most studies on promoting physical activity depend on subjects who are willing to change their behavior or voluntarily participate.

In this study, we report the preliminary results of intervention measures that focus on office workers who usually do not walk. Based on the PSD model [2], we conducted an experiment of competition between divisions for the purpose of promoting walking behavior within a corporate organization.

2   Methods

We conducted a behavioral change experiment by a walking event in a company with 300 employees. A walking app was developed to promote walking for employees. The event period was about two weeks, and one week before the event, the app was delivered to the smartphones by a mobile device management system. In the app, users could see two types of ranking: inter-division and intra-division. Former rankings were displayed on digital signage and placed in the office where people could easily see them (i.e. at the entrance and in the lunch area).
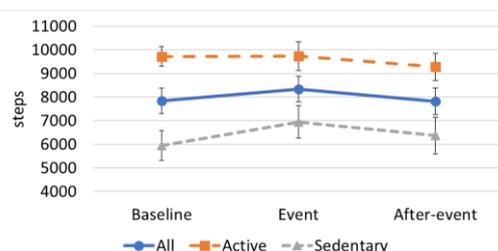
Fig. 1. Average number of steps at baseline through event taken by active and sedentary participants. Error bars show 95% confidence intervals.

In the analysis, we used walking steps data from 88 valid users and within that group also the questionnaire results from 68 users. The period was divided as before event period (baseline), event period (event), and after event period (after-event).

3　　Results

Questionnaire results showed that 20.6% of participants joined the events because of being conscious about health, and others because the event seemed interesting or they felt it as a kind of a job. Analysis was performed by defining the number of steps at the median baseline value of less than 7,685 steps as sedentary (n = 44). Sedentary people significantly increased the number of steps during the event period, which was 1.18 times compared to the baseline (P < 0.01, Fig. 1). Next, for sedentary people, we analyzed the correlation between the steps in the event period and the questionnaire item in order to determine the factors that influence the increase in the number of steps. As a result, health consciousness and walking awareness tended to be correlated with the steps in the event period (r = 0.22, n.s., r = 0.32, P < 0.05, respectively). These results suggest that the competition motivated sedentary people with potentially health-conscious to walk more in the event. However, in the after-event period the number of steps tended to relapse though it was statistically insignificant.

4　　Conclusion

We conducted a walking event system using a mobile app for promoting a walking activity of office workers. Many participants were recruited by making it a competitive event within and between divisions in the company. As a result, the number of steps of sedentary people were increased, especially for those who cared about the number of steps per day during the event period. Thus, it was possible to temporarily prompt walking behavior change of sedentary office workers by using social support. In future research, we will investigate using other persuasive features to maintain the behavior change effect over a longer term.

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TUTORIALS

Empowering Sustainable Change: Emergence of Transforming Wellbeing Theory

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Abstract. Majority of global problems and business challenges are byproducts of poor human attitude and behavior. Communities, societies, businesses, and organizations, basically everyone needs help with transformations. People often tend to perceive changes as something difficult, impossible, and mystical, thus are willing to avoid them. That attitude naturally leads to poorer decisions and consequent behavioral outcomes. This science-driven tutorial demystifies transformation by introducing *Transforming Wellbeing Theory* that explains the essentials of and inevitable necessity for transformation, *Typology of Change* that clarifies the variety of different changes and *Transforming Framework* that provides 8 (eight) applicable tools for bending technological innovations with human nature to empower sustainable changes at scale. Due to its scientific richness and practical nature, this transforming tutorial is applicable in many essential contexts, including wellbeing, health, innovation, leadership, autonomy, commercialization, education, diversity, culture, sustainability, dwelling, equality, social change, governance, automation, emergency, management, marketing, art, safety, ecology, and economy.

Keywords: Transforming Wellbeing Theory, Typology of Change, Persuasive Technology, Transforming Framework, Transformation, Design, Wellbeing

1 Transforming Wellbeing Theory

Transforming Wellbeing Theory is emerging as an inevitable response to the ever-growing imbalance in our lives across the globe [15]. Over the decades, we have been advancing technologies to make our lives better and businesses growing. The fundamental question still remains: with all the evolving technologies, are we gaining decent success in achieving healthier societies and well performing organizations? Every crucial domain of our lives continuously provides evidence of how things are getting imbalanced despite us making huge progress in building increasingly capable

innovations. This work summarizes the state-of-the-art scientific insights and practical applications to transform lives and accelerate businesses at global scale.

Present knowledge on persuasive technology often reveals how behavior change designs and interventions are limited in sustaining their effects [5-6]. There is an increasing need for novel ways to design technology that helps people not only to achieve their goals, but also to support sustaining their newly developed habits. Transforming innovations should ultimately empower people and organizations to succeed in their desired and more often even inevitable changes. Thus, the theory aims at extending the understanding beyond limitations of traditional change management and behavioral designs.

The theory is highly instrumental for organizations and communities that are designing for and undergoing transformations, as it provides and helps internalizing easy to use methods and tools for achieving permanent behavior change. This science-driven work embodies advanced knowledge on how to design sustainable changes, including *Typology of Change* and *Transforming Framework*.

2   Typology of Change

Scientific literature [1] [3-4] [16] reveals three general types of change: *transactional*, *transitional*, and *transformational* (Fig. 1). Transactional change is usually defined as an occurrence producing an outcome that differs from previous preferences. Then, transitional change is often defined as a period, in which certain outcomes significantly differ from what was habitual before. However, transformational change manifests itself as a continuum having direction as well as magnitude to produce apparently irreversible shifts.
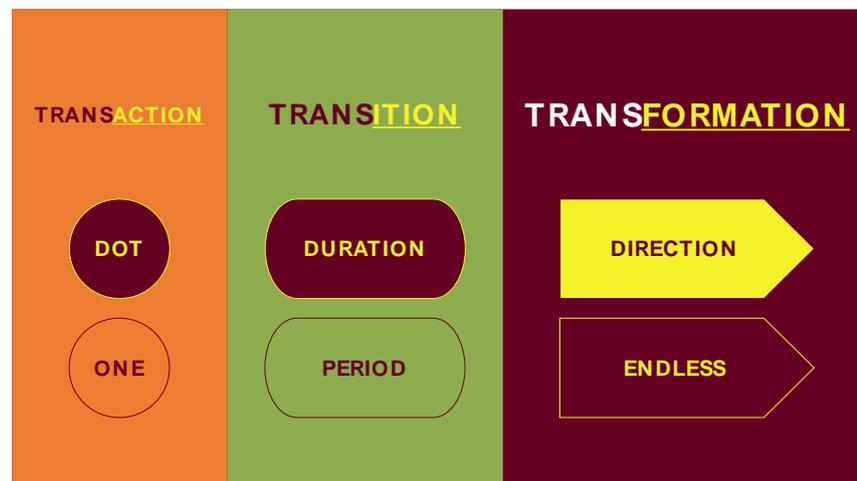
Fig. 3. Typology of Change.

The three types of change have their characteristics, including general descriptions, overall perspective, perceived timelines, orientations, nature, metrics, underlining psychology, and some examples provided in Table 1.

Table 2. Types of change and their characteristics.

	Transactional Change	**Transitional Change**	**Transformational Change**
Description	To carry on or conduct something to a conclusion or settlement.	Relating to a period during which something is changing from one state or form into another.	To change completely the appearance or character of something or someone, especially so that that thing or person is improved.
Perspective	One-time decision	Durational approach	Paradigm shifts
Time	Short-term	Defined-term	Timeless
Orientation	Cost-benefit	Goal	Identity development
Nature	Bargaining	Achievement	Directional
Metric	Decision	Milestone	Personality traits
Psychology	Economical	Motivational	Spiritual
Example	Riding a bike to a park to get free lunch.	Giving up alcohol for a month.	Becoming a true forgiver from now on.

3   Transforming Framework

Despite acknowledgeable progress in designing persuasive technologies, many behavioral design interventions still produce unsustainable effects on target audiences [8]. To help scientists and practitioners creating technology designs for sustainable change [7] and wellbeing [10], a science-driven *Transforming Framework* is introduced (Fig. 2).
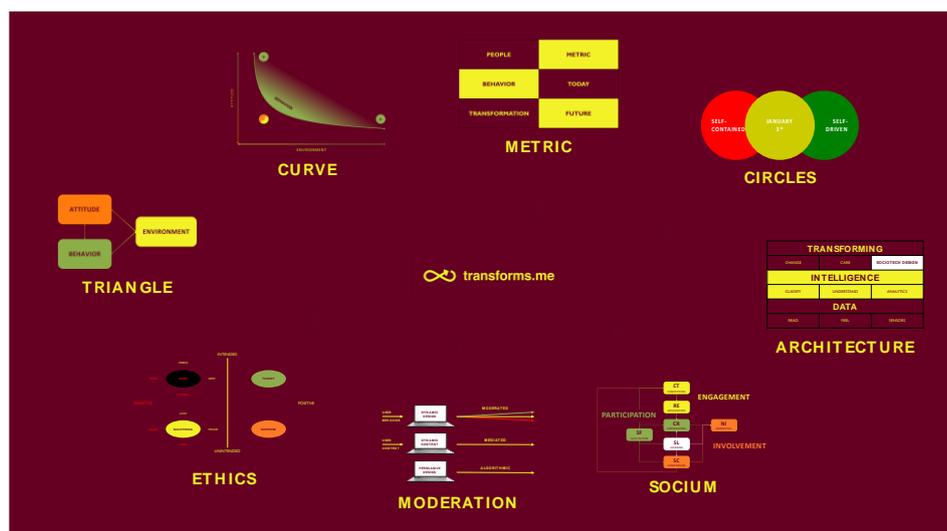
Fig. 4. Transforming Framework.

Transforming Framework embodies 8 (eight) scientifically driven tools that leverage prior knowledge on triadic reciprocal determinism (*TRIANGLE)* [2], elaboration and behavioral modeling *(CURVE)* [6] [9], essential components for defining transformation *(METRIC)* [14], susceptibility to influence and change *(CIRCLES)* [14], key layers of transforming technology design *(ARCHITECTURE)* [14], fundamentals of socially influencing systems *(SOCIUM)* [11], typology of computer-supported influence *(MODERATION)* [12], and dark patterns and persuasive backfiring *(ETHICS)* [13].

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Persuasive systems design, evaluation and research through the PSD model

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Abstract

Deep understanding of user behavior has become a key for successful design of modern information and communication technology [1, 2]. Moreover, a growing number of software, systems and services are being developed to change users' attitudes or behavior or both in areas such as fostering health and promoting sustainable/green behaviors. 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 presentation will introduce conceptual frameworks for designing, evaluating and researching persuasive systems, known as the Persuasive Systems Design (PSD) model [4] and the Behavior Change Support System (BCSS) framework [5]. The PSD describes the process for persuasive systems development and it explains what kind of software functionality may be implemented in the service or product. The model helps select effective persuasive features, and categorizes them into primary task, computer-human dialogue, system credibility, and social influence. It also highlights fundamentals behind any persuasive system and ways to analyze contexts for persuasion [6, 7]. Results from a variety of research projects utilizing approaches based on the PSD model and the BCSS framework will be presented.

The PSD model and BCSS framework can be applied for developing and evaluating both full-fledged interventions [8-10] and lighter persuasive applications [11, 12], carrying out systematic literature reviews [14-16], actually building the software for these applications [17] as well as user experience [3, 10] and actual intervention outcome research with these approaches [13, 18-20]. We make the claim that the topics addressed in this presentation will play a central role in all future IT design and is relevant for all future software business and economy.

Keywords: Behavior change; Behavior Change Support Systems; persuasive technology; Persuasive Systems Design; PSD.

Speaker bio

Harri Oinas-Kukkonen, PhD, is Professor of Information Systems at the University of Oulu, Finland. His main research interests are user behaviors, persuasive systems design, social influence, behavior change, and humanized technologies. His research

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WORKSHOPS

Personalizing Persuasive Technologies (PPT 2019): Personalization for Wellbeing

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Abstract. There is growing evidence that persuasive technologies are more likely to be effective in motivating behavioral change if personalized to the target users. This has led to an increasing interest in the field of personalized persuasive technologies (PPT) among researchers and practitioners in the academia and industry, respectively. For example, each of the last two PPT workshops in 2017 and 2018 attracted over 40 participants from over 10 different countries, alongside 12 peer-reviewed paper presentations and one keynote presentation. In the 2019 PPT workshop, we hope to build on the success of the previous years' workshops by focusing on the challenges and opportunities identified during the past workshops in the field of PPT and the subdomain of wellbeing. Thus, the 2019 PPT workshop aims to bring together different groups of researchers and practitioners from the academia and industry with a common interest of advancing the field of PPT in general and wellbeing in particular. Potential participants in the workshop are invited to present their work, share their ideas and experiences, discuss key challenges facing the field, and identify and deliberate on new opportunities that have the potential of moving the field forward. While the theme of this year's workshop is "Personalization for Wellbeing," the 2019 PPT workshop will cover many areas of personalization and tailoring, which include, but not limited to, user models on personalization, computational models on personalization, design and evaluation methods, and personalized persuasive technologies. We welcome submissions and ideas from the domains of persuasive technology and Human-Computer Interaction (HCI) in general, including but not limited to health, wellbeing, sustainability, education, entertainment, games, marketing, eCommerce, social media, safety and security. Successful workshop papers will be archived online and made accessible to the general public.

Website: The website for the workshop is
https://personalizedpersuasion2019.wordpress.com/

The 19th Workshop on Computational Models of Natural Argument (CMNA19)

The Role(s) of Argumentation in Persuasion

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1   Motivation and Topic

The CMNA workshop series focuses on the issue of modelling natural" argumentation where naturalness may range across a variety of forms, perhaps involving the use of visual rather than linguistic means to illustrate a point, for example using graphics or multimedia, or applying more sophisticated rhetorical devices, interacting at various layers of abstraction, or exploiting extra-rational" characteristics of the audience, taking into account emotions and affective factors. The study of Argumentation, and in particular, argumentative behavior within natural, real-world communication, compliments the scope and directions of the behavior change communities and aligns neatly with several aspects of the PERSUASIVE conferences. Computers and related digital technologies are tools that are increasingly used to help influence and persuade, as well as to manage and support. Similarly, the use of computers in argumentation has been varied, providing both a medium in which argumentative practices can flourish, and tools with which to study those practices. There appears however to be a natural alignment between the notion of argument as a rational process that can underpin reasoned action, and the idea of persuasive technologies leading to changes in behavior and habitual action.

For this edition of the CMNA workshop, we propose a special theme on the role(s) of argumentation in persuasion. This theme would be interpreted broadly, to support both polemical positions on, for example, whether argumentation can help or hinder persuasion, and to enable dissemination of recent work at the intersection of the fields. For example, recent work within the argumentation community has considered the use of arguments in formal models of persuasion as well as the role of argumentative dialogue in building motivation for behavior change.

Notwithstanding the special theme, we also solicit contribution addressing, but not limited to, the following areas of interest:

- The characteristics of natural arguments: ontological aspects and cognitive issues.
- The linguistic characteristics of natural argumentation, including discourse markers, sentence format, referring expressions, and style.
- The generation of natural argument
- Corpus argumentation results and techniques
- Models of natural legal argument
- Rhetoric and affect: the role of emotions, personalities, etc. in argumentation.
- The roles of licentiousness and deceit and the ethical implications of implemented systems demonstrating such features.
- Natural argumentation in multi-agent systems.
- Methods to better convey the structure of complex argument, including representation and summarization.
- Natural argumentation and media: visual arguments, multi-modal arguments, spoken arguments.
- Evaluative arguments and their application in AI systems (such as decision-support and advice-giving).
- Non-monotonic, defeasible and uncertain argumentation.
- The computational use of models from informal logic and argumentation theory.
- Computer supported collaborative argumentation, for pedagogy, e-democracy and public debate.
- Tools for interacting with structures of argument.
- Applications of argumentation-based systems.

2   The CMNA Workshop Series

Since its inception in 2001, Computational Models of Natural Argument (CMNA)[1] continues to attract high quality submissions from researchers around the world. During this period, CMNA has maintained a peripatetic nature by associating with major events, in order to foster cross fertilization between disciplines. For example, CMNA has been held over the years in conjunction with ECAI, IJCAI, AAAI, ICAIL/UMUAI, JURIX, and PRIMA. Like the past editions, CMNA18 acts to nurture and provide succour to the ever-growing community working in argument and computation. The series has seen notable growth in submissions since its start, and forms a complement to other, more recent series and events such as the ArgMAS workshops (focusing on Agents since 2004), the biennial COMMA conference series (focusing on computational models and tools since 2006) and the TAFA workshop series (focusing

on formal models since 2011). In the face of these other venues, CMNA maintains a distinct character with its focus on natural argument, continuing to provide inspiration and research challenges right across the fields of AI and cognitive science.

Previous instances of this workshop over the past seven years have seen attendance rates vary between a low of 18 (when it was with IJCAI in Hyderabad in Jan 2007) and a high of 30+ (with ECAI in 2006, with ICAIL in 2013 and with JURIX in 2014). The workshop series has been attracting a steady number of submissions and attendees since its inception in 2001, and past experience demonstrated that there are plenty of submissions available for CMNA, ArgMAS and COMMA to thrive even when all three have calls in the same 12-month period. We predict this year will continue this trend, with ever more people within AI turning to models of argumentation (in NLP, MAS, HCI, KRR and more), and ever more philosophers, linguists, lawyers and cognitive scientists, exploring interdisciplinary possibilities around argumentation. As these models and collaborations start to mature, a critical mass is emerging that is supporting steady growth. Many scholars have attended more than one CMNA workshop, which is not only an encouraging sign of the success of the workshops, but also a guide to those that might be expected to submit again. In addition, the workshop always enjoys further submissions from members of the organizing and programme committees. Of course, each year we have also been receiving more submissions from people new to the community: CMNA is unique in the way in which it moves and co-locates with different main conferences, and hence addressing each year different communities. This has proven a good opportunity to gain new interest, as well as to enrich the notion of natural argumentation, by incorporating insights from many different traditions. We believe that this year will continue this trend, and we look forward for a new perspective on CMNA coming from the Cognitive Science community.

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") [6]. 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 [56,7,8]. 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 multi-disciplinary 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 [9].

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 interaction is 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.

3   Organization and Submissions

A single day has usually been sufficient for most CMNA workshops, though we had so many good papers in 2006 with ECAI that we extended the work-shop to two days. A typical schedule for a one-day event can be viewed online at http://www.cmna.info/CMNA13/Programme.html describing CMNA 2013, which ran with UMUAI+ICAIL in Rome.

We aim to attract not just discursive and theoretical pieces, but also results from applications and implementations of ideas presented and discussed at earlier workshops. Traditionally we accept a mixture of submissions comprising both long and short papers. This enables us to strike a balance between mature work on the one hand and more cutting edge or polemical discussion pieces on the other. The deadline for short paper submissions is usually closer to the workshop itself which provides an opportunity to support late breaking findings. A key characteristic of CMNA has been the structuring of presentations around ample discussion time, an approach that is designed to facilitate both a cross-disciplinary meeting of minds and to foster interaction and collaboration. The workshop has strived in previous years to provide, primarily, an informal forum for discussion, a venue to foster discussion and encourage cooperation, rather than being a mere collection of papers. To facilitate this, we distribute all papers accepted (by multiple reviewer blind review) to all participants well in advance of the event, to improve coherence and interaction. An invited keynote has also been a tradition for CMNA, and CMNA19 will be no exception.

Our programme committee has been established over the years and many members return to the PC annually. The current membership stands at around 25 active scholars from around the world who frequently also contribute to and support the event.

3.1   Steering Committee

Floriana Grasso is one of the founding organizers of the CMNA Workshop series, and has led its growth over the past decade. She is on the editorial board of the journal Argument and Computation[2] (Taylor and Francis), a recent but already authoritative lead publication in the field. She works on argumentation, persuasiveness, and affective communication, especially looking at extra-rational features (values, emotions). She applies her research in the area of public health informatics. She organized many workshops and events in the area of argumentation, persuasive technology and motivation.

Nancy Green has long been involved as contributor and programme committee member since the series inception, and part of the organizing committee since 2007; she chaired the CMNA meeting in 2009, co-located with IJCAI'2009. Nancy works on computational models/analysis of dialogue, argumentation, narrative, stylistic variation and conversational implicature, argument mining and multimedia document generation. She has organized many events, besides CMNA, including a number of AAAI symposia.

Jodi Schneider joined the Steering Committee of the Computational Models of Natural Argument series in 2018. She has served on diverse program committees and is currently Associate Chair, Understanding People Subcommittee of the ACM CHI Conference on Human Factors in Computing Systems 2019. She has organized several workshops and events, most recently a panel on Innovations in Reasoning and Arguing about Health" at the 2nd European Conference on Argumentation: Argumentation and Inference. She researches argumentation, evidence, and persuasion, with particular attention to health literature.

Simon Wells joins the CMNA steering committee and was previously part of the organizing committee for the 2018 PERSUASIVE workshop on Uncovering Dark Patterns in Persuasive Technology" and the 2018 Trust in Intelligent Machines (TIM)" workshop. The TIM workshop lead to a joint publication in IEEE Technology & Society magazine[3] and a second meeting is in preparation to be hosted by the Technische Hochschule Mittelhessen in 2019. Simon is, with colleagues, organizing a workshop on Intelligent Machines and Human Behaviour to be hosted at the AISB annual convention in 2019. He builds computational models of arguments and dialogue then investigates contexts in which they are used; during dialogue, persuasion, and other strategic interactions.

Seventh International Workshop on Behavior Change Support Systems (BCSS 2019)

In conjunction with the 14th International Conference on Persuasive Technology,
April 9-11, 2019, Limassol, Cyprus

Programme Chair
Sriram Iyengar, Texas A&M, TX, USA

Organizing Chair
Piiastiina Tikka, University of Oulu, Finland

General Co-Chairs
Harri Oinas-Kukkonen, University of Oulu, Finland, and
Lisette van Gemert-Pijnen, University of Twente, The Netherlands

1   Introduction

Technology has found its way into almost all aspects of modern life: sensors, trackers, and processing power as never before are here with profound implications for almost every aspect of our lives. In particular, devices such as smart phones, fit-ness trackers, smart watches and wearable sensors offer great potential to apply Persuasive Technology (PT) towards behaviors beneficial to individuals, society and the environment [1,2,3]. Behavioral design is rapidly becoming integrated into user inter-action (UX) design, and persuasive systems can become seamlessly integrated in our everyday lives.

Persuasive Technology/BCSS 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. Because PT is a young discipline, most if not all of these interventions have been able to demonstrate effects over the short term ranging from 1 to 2 years. However, many of the health challenges facing individuals worldwide are chronic long-term illnesses such as metabolic syndrome, diabetes obesity, depression, hypertension and so on. These diseases demand that the afflicted individual engage in long-term behavior change over the span of 5, 10, 15+ years. There is an increasingly urgent need to develop an understanding of PT/BCSS constructs, tools, models, and evaluation methodologies to enable such long-term behavior change as well as to predict long-term effectiveness and acceptability of proposed PT/BCSS interventions.

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 inter-active workshop will act as a forum where experts from multiple disciplines can pre-sent their work and can discuss and debate the present-day challenges for persuasive technology.

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*" [4].

2   Background

Whether lifestyle-related or managing a chronic illness, behavior change requires longevity. Either through sustained use of a system, or in terms of lasting effects. Where it is necessary to observe and understand the immediate effects of BCSSs on behavior, it is also necessary to highlight the need for the broader time span view on the use and effects of these systems. For example, with chronic illnesses such as hypertension, diabetes, or depression, the diagnosis and following treatments are often merely the beginning for the patient, who then enters a life-long self-management process regarding his or her condition. Similarly, a long-time favorite of the persuasive technology field and BCSS interventions, obesity [5], is a slow process where overweight that is collected over years will also take years to take off. Other behavioral domains, from wellbeing to ecological behaviors, often involve a more sustained learning and rehearsal curve, and systems that remain helpful and supportive for the users beyond a few weeks or months could potentially lead to behavior change that is still effective years later.

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") [6]. 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 [56,7,8]. 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 multi-disciplinary 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 [9].

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 interaction is 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.

3   Topics

Topics for submissions include, but are not limited to:

Design & Development:
- Supporting sustained system use
- Designing BCSSs and persuasive technology for long-term effectiveness
- Countering attrition
- 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 stake-holders, implementation issues.
- Persuasive strategies related to different outcomes (engagement/resilience/attitudes/compliance/behaviors) and levels (individual/community/society) of change.

Evaluation:
- Predicting long-term effectiveness of BCSSs
- Measuring the impact of BCSSs and smart persuasive environments on individuals, community, and society – immediate or long-term
- Conducting longitudinal studies with BCSSs
- Measures of long-term efficacy

- 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.

4 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) workshop around present day challenges regarding sustained system use and longitudinal research with BCSSs.

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DOCTORAL CONSORTIUM SUBMISSIONS

A Cybernetic Approach to Good Governance of Pervasive Industry Platforms

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Abstract. In recent years, there have been prolific conversations concerning the negative impact of pervasive industry platforms, which to an increasing extent mediate people's communication and lives. There are growing concerns about persistent governance challenges related to these platforms and a lack of tools for regulators, owners, board members and managers to deal with these issues. This research uses design methods to explore new ways of describing and governing digital platforms, which uses persuasive technologies to create and sustain their competitive advantage. Using an action research methodology based on service design methods, the researcher will develop new knowledge and tools for improved governance of digital industry platforms. The tools are inspired by cybernetics and contemporary persuasive technology research.

1   Introduction

This research aims to tackle some of the emerging challenges with persuasive technologies as used in pervasive industry platforms. As Timmer et al. described, computers are constantly changing shape, which continuously opens up for new forms of persuasion. [16] Ambient persuasion [17], subliminal persuasion [1] and persuasion profiling [9] are all new research directions which has emerged as a reaction to these underlying change in computer hardware and software - the substrate of persuasive technologies. Mounting evidence shows that there is a growing governance issue with pervasive industry platforms, and they have been accused of preying on human attention and taking unacceptable privacy risks [19], deceiving its users through dark design patterns [12, 4] and possibly even triggering mental illnesses in certain user groups [13]. These problems are messy and wicked to their nature and because they are notoriously difficult to pin down, it is also difficult to understand where to begin looking for solutions. This research builds on the idea that cybernetics holds great potential as a language for describing 'behaviour focused design' [2]. Cybernetics is a transdiscipline, which explores similarities in mechanical, biological and social systems [3]. Norbert Wiener formulated a commonly used definition of cybernetics in 1965,

stating that cybernetics is the science of 'communication and control of the animal and the machines' [18]. It is fundamentally a systems science, which concerns 'systems with goals', or 'systems with circular causality' [8]. This research builds on these ideas and seeks to show that the systems-based approaches of cybernetics and in particular, the constructivist approach of second-order cybernetics are useful concepts to understand how persuasive platforms should be understood and governed, in the light of the evolving computing landscape. As the influence of persuasive platforms grows, I am particularly interested in how goals are negotiated in the design of pervasive industry platforms using persuasive technologies and how cybernetic thinking can facilitate our understanding of how these platforms are governed. The term governance was minted in political science, but the concept has been translated into many different contexts. The reason I use the term governance in this research is because of the politicization of design which Dubberly and Pangaro allude to in their work, where ethical, societal and user goals are negotiated already on the design stage of services or products [2]. If we subscribe to that assumption, argumentation and rhetorics are key design skills and governance is a concept which is suitable describes this political process of goal setting and boundary setting. As Rittel and Webber first pointed out in 1973, framing the problem in design is in itself a political act and if that is the case, argumentation and rhetorics are important design skills [14]. Persuasive technologies and pervasive industry platforms, which are prolific users of tactics and strategies from persuasive technology research, are with Rittel's perspective, inherently political. These technological platforms now mediate a large share of human life, why the quality of the political conversations regarding the design of digital platforms becomes vastly more important.

2   Pervasive industry platforms using persuasive technologies

In 1999, the personal computer revolution was in full swing and is also the approximate time when the field of persuasive technologies was born at Stanford, with BJ Fogg's pioneering work on Charismatic Computers [6]. Persuasive technologies are broadly defined as the study of computer systems designed with intent to persuade, i.e. computer systems with persuasive goals [5]. Apart from a recent study by Shao et al., there have been few studies in persuasive technology research explicitly concerning persuasive technologies and governance [15]. Certain aspects of governance have been touched upon, for example there has been a vivid discussion about ethics and goal-setting, but none that has addressed the overlap between persuasive technologies, governance and management. Neither has cybernetics been explored extensively in the specific context of persuasive technologies. There are many apparent similarities between persuasive technologies and cybernetics, which has not yet been explored, in existing scholarship. Both fields concern goal-oriented systems, they concern communication and control of people's behaviours and actions and recursive, circular functions which 'learn' and adapt the system according to its goals. Through this research, I will thus explore if the cybernetic theories of 'communication and control in the animal and the machine' can be used as a blueprint for understanding and designing persuasive technologies and systems.

3   Research questions

The aim of the research is to understand how second-order governance tools for persuasive platforms could be designed.

R1: What does a cybernetic approach contribute to the understanding of persuasive technologies?
R2: How can different concepts from cybernetics be applied in a persuasive platform governance design project?
R3: How can a service design approach inspired by concepts from cybernetics contribute to improved governance of persuasive platforms?

   The contribution of this research is thus a theoretical contribution in the nexus between persuasive technology research, cybernetics and design, which leads to new understanding and practices for designing governance measures for persuasive platforms.

4   Methodology and methods

To arrive at a framework or novel approach to a solution, I mainly use methodology and methods from design research. In contrast to traditional science, which largely aims to understand and explain the existing world, design research is concerned with developing new solutions - to imagine and build concepts, which does not yet exist. Design research is appropriate for problems which are wicked to their nature and where little theory is available [14]. The main method used in the study is action research, a methodology pioneered by Kurt Lewin where strategies for addressing a challenge is developed in situ, and where new knowledge is created through action [10]. Action research involves the active participation of the researcher in a change project, where the researcher actively designs something, often in collaboration with a need owner, an organization or group of people, in the joint search for a solution. This makes this research for design (for designers to use) and through design (generating new knowledge in the act of designing), as per Christopher Frayling's definitions [7]. In this case, the goal of the action research process is to develop a language for describing persuasive systems using cybernetics and arrives at tools and a framework for governance of pervasive industry platforms. The research questions are explored through a series of applied service design projects, where I work together with selected organizations in an action research process, to arrive at solutions and create new knowledge about the problem area and possible solutions in the design process. In the course of the research, I draw on theories of persuasive technologies, conversation theory from second-order cybernetics and design research.

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Automated web personalization in the automotive sector: the SEAT case

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Keywords: Website personalization, Website automation, Automotive company website.

1 Introduction

This research is the result of an industrial PhD program co-supervised by the university Universitat Politècnica de Catalunya-Barcelona Tech. and developed inside a company of the automotive sector SEAT, S.A. For this reason, real data form the industry is used for the different study and analysis and most potential outcomes are oriented toward the practical application of personalization.

2 Research context

The research context of this study is framed around three main topics: web personalization, personalization automation and websites of the automotive sector. The first one, web personalization, involves the study of the impact of personalization in the company-customers' communications based on the web channel [1], [2]. Adapting or personalizing the persuasive approach to each target user has lately gained much attention for many fields that study persuasion [1], [3]. In addition to marketing and information systems, personalization has also drawn increasing research importance in various other fields, such as computer science, management and economics [4]. Because of this broad interest it is not difficult to find personalization scholars, supporters, experts and related research papers. However, finding a general definition or agreement on strategies, effects on individuals' behavior or user perception of personalizing persuasive technologies is not an easy task [3], [5]. This discrepancy in the conceptualization of the most relevant vocabulary in the topic is, in some sense, due to the variety of fields involved in its development [6]. Also, the difficulty of implementing personalization in an organization's real marketing mix is added to the skepticism of some scholars and companies regarding its real effectiveness for attitudinal change and business results [7], [8]. Based on the outline used in [7] the reviewed literature has been classified in three main blocks:

- Theoretical foundations. Including, for example, main terminology discrepancies [5], different strategy definitions [6] or the effects of web personalization on business results [8].
- User-specific aspects. Including, for example, users' satisfaction [9], users' privacy concerns [10] or users' contextual factors [11].

- Technical and procedural implementation. Including aspects of recommender systems [12], data collection and processing [13] or profiling [14].

The second topic, personalization automation, consists in a broad concept with several valid meanings. Some of them are based on the personalization outcome (what the user sees) reflect the idea of self-acting website adaptation without user action based on some predefined aspects or rules [4], [15]. Some others use 'automated web personalization' as referring to automatic profiling [12] or automatic recommendations [16]. In this research, by 'automatic web personalization' we refer to the automation of the entire process of personalization.

Finally, the third main topic framing this research, deals with the consideration of web pages of the automotive sector. This sector is characterized by intense competition, as customers have multitude of alternatives [17]. In this context companies of the automotive sector have had to investigate new approaches to solve their problems and to remain competitive [18]. Nowadays e-commerce environments provide opportunities for implementing customization strategies, which allow users configure their own individual solutions by selecting from a list of options and components, the same also stands for the automotive sector as they allow to configure their cars in their websites [19]. However, these systems commonly deal with the problem of mass confusion (the situation where the customer becomes confused by the excess variety of possibilities) and personalization could help user to not to feel this confusion [20]. Nevertheless, even if there is some research in the automotive sector digitalization, there is a lack of study regarding webs of the automotive sector [21].

As seen in the previous paragraphs, multiple research has been done on personalization (and web personalization) over time, both in the conceptual aspects [22] and in more practical aspects [23]. However, there is still not a consensus in conceptualization and a general framework is needed both to clarify the definition of the term personalization and to differentiate the possible personalization strategies. Furthermore, although there is some research on web automation and personalization automation, there is still a lack of research aiming to automatize the entire process of web personalization, what is even more scant when considering the practical application of this automation in a real company. Finally, there is almost an absence of research on websites of companies of the automotive sector or on how to use persuasive technologies to reliably affect users' attitudes towards the car brand. This research could include both, the vehicles e-commerce websites (or vehicle parts and spares of the vehicle) and the brand websites (websites devoted to brands, brand building and designed to be an integral part of the firm's overall advertising campaigns) [24].

In conclusion, a research gap exists in the automated personalization of websites. And, another research gap can be found in the special case of the websites of companies of the automotive sector. Thus, trying to fill the combined gap of these three different fields (personalization, web automation and automotive sector websites) presents a challenge by itself. With it, in order to shed light into these gaps, the central research question (RQ) of this thesis is:

RQ: Which are the necessary considerations to design an automatically personalized website in the automotive sector able to increase the most relevant key parameter indicators (KPIs)?

3 Research plan

As this study presents a wide question, we propose an approach divided into five main studies that will set the main blocks of the project. Such specific studies are:

1. Personalization definition. This first study is needed in order to frame the research into a clear set of concepts and dimensions. As previously seen, personalization is sometimes not a clear concept and many authors presented varying sets of dimensions. The objective of this first study is to develop a conceptual framework based on the consolidation of the diverse existent other classifications used for personalization strategies.
2. Web users' segmentation. The research question of this study is: Which users a segmentation criterion allows us to know better our users to get a good web personalization? The purpose of this study is to find segmentation criteria based on the combination of previous one. With it, we expect to demonstrate that, to segment the audience of a website using a combination of criterion and a sequence of methods results in a better quality than choosing an only method even if it is based in a combination of criterion. Also, we expect to find different results for different personalization strategies.
3. Web performance analysis. The research question of this study is: Which changes of elements of a website in the automotive sector are influencing the most in the user in order to convert in a KPI? The purpose of this study is to lay the foundations for the prioritization of potential changes to be done in websites of the automotive sector, both considering their effect on user behavior and also the cost (economical and non-economical). With this study we expect to obtain a ranking of possible changes to be applied on the website, useful in the decision making of web personalization and also in website management of the company.
4. Testing procedure. The research question of this study is: What is the most appropriate way of testing each kind of variations in a website when personalizing? The objective of this study is to understand how each change on the website should be tested, to describe different approaches currently used for online testing and to determine the optimal testing and analysis approach for each case.
5. Web personalization automation. The research question of this study is: Which are the factors that have to be considered to obtain an efficient approach to the automation of a website personalization? The purpose of this study is to combine the outcomes of all the previous studies with a real company website work-flow in order to determine how each phase of the personalization process could be automatized.

Currently, the first and fourth studies have already been covered. Some advances have also been done regarding studies second and fifth.

4 Conclusions

Based on the relevance of bringing the customers the best possible web experience, the aim of this project is to find suitable content for each user as well as a viable methodology to automatically personalize the web content for users on the automotive industry. With this purpose qualitative and quantitative data form different sources is gathered and analyzed. Some of this data sources are a website of an automotive-sector

company (SEAT, S.A.), partners, academia and studies of market research, together with the observation of competitors' websites and empirical field of the research will be the SEAT website, mainly focused on the Spanish market.

Finally, the expected result is a theoretical framework for the automatic personalization of a website considering different personalization possibilities.

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Personalizing Argumentation Through Narrative Within Persuasive Technology

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Abstract. This paper outlines our aim to build a persuasive system that delivers a personalized narrative and to discover if we can transform a user's behaviour by moving them through the stages of change: precontemplation, contemplation, preparation, action and maintenance. The domain of our research will be Type 2 Diabetes which affects over 373 million people, with profound consequences for patients, their careers and health systems. As well as describing our aims and objectives, we relay the work completed so far and the future work we must complete.

Keywords: BCSS · Persuasive Narratives · Behaviour Transformation.

1   Introduction

It is the aim of this project to develop a computational system that can help people with Type 2 Diabetes (T2D) to successfully manage their condition by supporting them to transform their unhealthy beliefs and behaviours through the use of personalized narratives.

Over 373 million people live with T2D worldwide with a further 193 million people having undiagnosed T2D [1]. This condition leads to complications that cause profound psychological and physical distress to patients and the people who care for them [11]. With global costs for treating Diabetes estimated at $825 billion, it is a hugely significant issue.

T2D is characterized by insulin insensitivity and is primarily managed by adopting a healthier lifestyle, with evidence showing the majority of people who successfully lose weight achieving remission [5].

2   Aims and Objectives

Within the field of Persuasive Technology (PT), current research has focused mainly on directly influencing behaviour change rather than eliciting changes first through a person's beliefs. The emphasis on behaviour change may be shifting, with researchers considering how to transform behaviour permanently [10] rather than eliciting a temporary change while a Behaviour Change Support System (BCSS) is being utilised

[3]. In order to transform a person's behaviour, their beliefs and attitudes must be considered.

Through shifting the focus from changing a user's behaviour to changing their beliefs, we propose that we can implement a transformation in their behaviour that can be maintained even after the BCSS is no longer being used. To measure this, we will establish where a person resides within the Transtheoretical Model [7] and whether they have transitioned from one stage to another.

As Nguyen and Masthoff suggest, although many BCSSs take a direct approach to persuasion, this approach may be counterproductive and that incorporating a Motivational Interviewing (MI) style to derive the goals and motivations from the user themselves, may be a more persuasive approach to take [6].Instead of attempting to persuade the user directly through a causal argument, as is an extremely common approach within health behaviour change as noted by Schellens and De Jong [8], we aim to encourage the users to achieve their own goals in transforming their behaviour through the use of a narrative. By using a narrative, the aim is to utilize an indirect approach to persuasion that can circumnavigate the difficulties within direct argumentation.

To measure the effect of this, we must be able to build a detailed model of our user, including their demographic details and their personality. We can then adapt the stories to the user and therefore investigate the persuasiveness of the system and its impact in transforming the user's beliefs and behaviours. This leads us to our main research question and hypothesis:

Research Question: (How) can Persuasive Technology move a user through the stages of change?
Hypothesis: Persuasive Technology can move a user through the stages of change by incorporating argumentation through personalized narrative.

3   Work Completed

To understand how a dialogue between multiple health-care professionals and patients could take place, we organized audio and video recording sessions with a number of health-care professionals, including a motivational interviewer, and actors playing the role of patients. From initial analysis of the transcripts of these sessions the techniques used by the motivational interviewing expert were particularly interesting. To gain further insights we enrolled on a motivational interviewing course and were given an overview of the techniques and philosophy of motivational interviewing as well as how to use these techniques in a practical setting.

From initial analysis of these transcripts we developed a dialogue game for multi-party goal-setting in health coaching [9]. In this dialogue game, two or more health coaches work with a patient to decide upon an agreeable goal. We intend to build on this dialogue game to incorporate delivering a personalized narrative.

To understand how persuasive a BCSS is, we developed a measuring and evaluation matrix [2], which by incorporating ideas from argumentation, outlines the factors that may be considered when measuring and evaluating a BCSS.

To test our Matrix and to expand it into a framework, we devised an experiment [4] to evaluate the effects of multiple agents on user persuasion with our colleagues

Reshmashree B. Kantharaju and Catherine Pelachaud from Sorborne Universite. Along with gender and *status* (authoritative and peer), we also looked at the type of *focus* employed by the agent i.e. *user-directed* where the agent aims to persuade by addressing the user directly and *vicarious* where the agent aims to persuade the user, who is an observer, indirectly by engaging another agent in the discussion. The main finding was that, a multiple agent setting was more effective than a single agent. The persuasiveness questionnaire revealed that participants reported being more influenced by the user-directed multiple agent setting. However, we measured the mean change in rating for each condition and this revealed that the vicarious setting was more effective.

4   Future Work

To achieve our aims and objectives, we have split the necessary work into 9 work packages, each with their own deliverable.

Work package 1 is concerned with investigating the correlation between personality and persuasion. We will design the experiment in conjunction with our colleagues, who are experts in creating virtual characters. We will then deploy the experiment and analyse the results. For our first deliverable we will produce a paper detailing the experiment and our findings.

The second work package will look to develop a computational tool to gauge where our users currently reside on the stages of change, before developing a methodology to assess their current beliefs and behaviours. Deliverable 2 will be a paper outlining the methods we will use to assess what stage of change the user is in and how we will measure their current beliefs and behaviours.

In work package 3 we will design and hold a workshop on devising persuasive narratives. In this workshop we will invite experts from the fields of healthcare, health-care information, behaviour change & story creation as well as from potential users. We will look to gain insights into how a persuasive story within a health-care setting can be created before producing outlines for each of our story scenarios in deliverable 3.

Work package 4 will involve a review of the literature on how narratives in general and persuasive health narratives in particular are created. To help us understand the creative writing process, we will enroll in a class or module in creative writing. With these new skills and knowledge base we will then work on deliverable 4, the persuasive narratives we will utilize within our system.

In the fifth work package we will investigate how to personalize these narratives. First by developing the variables we can adapt within each narrative. We must then consider how to incorporate a personalized argumentative approach before designing our narrative personalization algorithm for deliverable 5.

In work package 6 we must design the methodology for how we will evaluate our system. This will require research into current evaluating methods as well as incorporating insights gained from our completed work on measuring and evaluating persuasion. In deliverable 6 we will produce a detailed design of the experiment we will hold to evaluate our system.

Work package 7 is where we will develop the system. This will revolve around a User Centered Design (UCD) approach in which we will recruit users to inform the development process. We will hold several user consultations in which we evaluate the current system as it stands and use this feedback to specify user requirements for

improvements. Our development will be split into 4 sprints following an agile approach and at the end of the development process we will have our finished system and deliverable 7.

The eighth work package is where we will evaluate our system. To complete this package we must recruit participants, run the experiment and hold user and expert workshops. We will then analyze the results from our experiment before writing up our findings in a report or paper for deliverable 8.

Finally, in work package nine we will produce our thesis and deliverable 9 where we outline the research project as a whole and describe our findings and the conclusions we have reached.

5   Acknowledgements

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Persuasive Technology 2019Doctoral Consortium

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Abstract. In this contribution, I present the first results and the things that I am currently working on. However, the main focus are the issues that I am dealing with. The issues relate to methods of data collection, data analyses as well as discussions with other researchers regarding the field of persuasive technologies.

Keywords: Health Care, Robotics, Persuasion, Trust

1   Introduction

I am doing my Ph.D. at the Department of Design and Communication at the University of Southern Denmark under the supervision of Kerstin Fischer. I have a background in Business Communication and Communication Design. The current working title of my Ph.D. project is *"Increasing Trust in Human- Robot Interaction with Focus on Persuasion"*. My Ph.D. is situated in the research project SMOOTH[1], which is funded by Innovation Fund Denmark. The SMOOTH-project aims at creating robots for the support of elderly people and their caregivers. I am currently on my first external stay at the University of Technology in Eindhoven (14.01.2019-28.02.2019). Here, I work together with Jaap Ham.

2   Research Aims

The overall research aim of the thesis is to help increase people's, especially elderly people's, trust in robots. This is addressed on two specific questions, namely how people can be persuaded to take in more fluids and how exactly   a robot should inform its users about its capabilities, for instance, whether directly or indirectly, with what kinds of linguistic resources, and on what kinds of capabilities. This project will develop general strategies for designing utterances for a robot to gain its user's trust and to persuade the users to take in some fluids.

3 Methods for data collection and data analyses

The primary method for data collection is experiments. These experiments are human-robot interactions in different varieties. Participants are always videotaped during the experiments. The videos are used for qualitative analyses. Furthermore, participants fill out questionnaires, which are used for statistical analyses. I am thinking about conducting online surveys, where participants watch a video about a robot telling them something, and afterwards they answer some questions regarding this robot. These online surveys could concern trust. I am also thinking about interviews or focus group interviews. This could be done in different ways, for instance:

- After short experiments, where I gather more qualitative data instead of only questionnaire data
- With elderly people (or caregivers), where I show them videos of human- robot interaction with realistic scenarios

I want to combine qualitative and quantitative methods for both collecting and analyzing my data. For the qualitative data analysis, I will primarily use Conversation Analysis. For this, I have different ideas, for instance, collections and/or short interaction analyses of specific parts of the interaction. However, I have some concerns regarding this mixed method approach. I am struggling with questions such as:

1. Can I run experiments and interviews as part of my project? Can these different approaches be compared to each other? Alternatively, do I have to choose one approach and be consistent?
2. Do I have to do qualitative data analyses in all my experiments or can I leave out experiments where qualitative analyses do not make sense? Or will this be seen as inconsistent?

4 Results

So far, my experiments focus on which strategies to use to persuade people to drink water. When we get older, we lose our sense of thirst, so we forget to drink enough. In each experiment, we have measured the water intake of participants. Water intake is measured in milliliters after participants finished the experiment. For experiment 1 and 2 we have used *Casper*, see Fig. 1. We have used the same scenario in both experiments, which is as followed: The robot guide participants through a lab and collect all they need to set up a table for a nice snack.

4.1 Experiment 1

Fig. 1. This is Casper. It is a low-fidelity prototype, coated in styrofoam and equipped with a pair of eyes made from bottle caps. The robot is a Turtlebot 2 on a Yujin Kobuki mobile base.

The first experiment is carried out at our HRI-lab in Sønderborg. Our participants are staff and students from the university. When participants pick up a glass, the robot said: "It is important to drink enough water during the day". The next sentence was of our interest, in one condition (general) the robot said: "Most participants drink half a liter after this game". In the other condition (gender-specific), it said: "Most female/male participants drink half a liter after this game", depending on whether the participant was female or male. In the baseline condition, the robot said nothing at all. This strategy is based on R. Cialdini and is called *Social Proof* [1]. Results show significant behavioral effects regarding water intake. In the baseline condition, people drank on average 55ml, in the general condition 73ml and in the gender-specific condition 112ml. The difference between the gender-specific and the baseline condition is significant ($p= .04$).

4.2 Experiment 2

The second experiment is carried out at the Living Lab in Sønderborg[2]. Our participants are mainly staff from care facilities but also other people who work with the elderly daily, like nurses. In this experiment, we studied the effect of bringing scientific expertise. This is based on R. Cialdini too, but this time it is a way of expressing *Authority* [**1**]. When participants pick up a glass, the robot said: "It is important to drink enough water during the day". Then, the robot either said "Research shows how important it is to drink enough water" or the robot said, "You as an expert know how important it is to drink enough water".

Again, in the baseline condition, the robot said nothing. Results show significant behavioral effects regarding water intake. In the baseline condition, people drank on average 20ml, in the research condition 60ml and in the expert condition 68ml. The difference between research and baseline condition is significant ($p= .04$). The difference between expert and baseline condition is significant ($p= .01$) too.

So far, the experiments have shown that the more precisely the robot can identify the communication partner, and the more the robot take the communication partner into

account, the more participants drink and thus the more persuasive the dialog proves to be.

4.3   Experiment 3

I am currently working on my third experiment together with Jaap Ham. For this experiment, we use the Socibot Mini, which informs participants about the importance of water intake. Participants will meet three robots. The first robot, Chris, gives only advice about the importance of water intake. The second robot, James, uses personalization without empathy when he gives advice. The third robot, Ryan, uses personalization with empathy when he gives advice. As in the first two experiments, we will measure how much water participants drink during each interaction. After the interaction with each robot, the participants have to fill out a post-questionnaire to see how persuaded they are by the different robots.

5   Results

I have some more general issues concerning the field of persuasive technologies. First, I get many comments regarding the wording persuasion, persuasive technologies and nudging. I also have discussions about how "bad" persuasion is, especially if you implement it in, for instance, health care and/or with focus on behavior and behavior change. I want to discuss how other researchers in this field deal with these kinds of discussions.

Next, regarding persuasion, you also strike the discussion about ethical considerations. I find this a challenging topic, and I do not know how to handle this. How do other researchers handle ethical considerations for persuasive technologies?

Last, regarding studies on trust, I meet many opinions among other researchers. You can define trust in different ways, but often trust is used in regard to a more long-term relationship. This is also why I have troubles designing these experiments. Many of my participants have little or no experience with robots at all. However, I still believe that trust is an important aspect, especially when you design a robot for vulnerable users like the elderly. So, how can people be persuaded by a technology and still trust it?

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