Lecture Notes in Computer Science 3962

Commenced Publication in 1973
Founding and Former Series Editors:
Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

Wijnand IJsselsteijn Yvonne de Kort
Cees Midden Berry Eggen
Elise van den Hoven (Eds.)

Persuasive Technology

First International Conference on Persuasive Technology for Human Well-Being, PERSUASIVE 2006
Eindhoven, The Netherlands, May 18-19, 2006
Proceedings

Springer

Volume Editors

Wijnand IJsselsteijn
Yvonne de Kort
Cees Midden
Eindhoven University of Technology
Technology Management
P.O.Box 513, 5600 MB Eindhoven, The Netherlands
E-mail: {w.a.ijsselsteijn,y.a.w.d.kort,c.j.h.midden}@tue.nl

Berry Eggen
Elise van den Hoven
Eindhoven University of Technology
Industrial Design
P.O. Box 513, 5600 MB Eindhoven, The Netherlands
E-mail: {j.h.eggen,e.v.d.hoven}@tue.nl

Library of Congress Control Number: 2006925249

CR Subject Classification (1998): H.5, H.1, J.3-4, K.4.1, I.6, I.2.0, I.2.6

LNCS Sublibrary: SL 3 – Information Systems and Application, incl. Internet/Web and HCI

ISSN 0302-9743
ISBN-10 3-540-34291-5 Springer Berlin Heidelberg New York
ISBN-13 978-3-540-34291-5 Springer Berlin Heidelberg New York

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper SPIN: 11755494 06/3142 5 4 3 2 1 0

Preface

Persuasive technology is the general class of technology that has the explicit purpose of changing human attitudes and behaviours. Persuasive technologies apply principles of social psychology in influencing people; principles of credibility, trust, reciprocity, authority and the like. Social psychologists have spent a great deal of effort over many years in trying to understand how attitude and behaviour change comes about, focusing on the effectiveness of human persuaders, and the persuasive power of messages delivered through non-interactive mass-media, such as newspapers or television. Harnessing the persuasive power of current interactive media, persuasive technology was recently identified as a separate research field, as evidenced by B.J. Fogg's first discussion of the domain[1]. Fogg characterises computers designed to persuade as the 5th major wave in computing[2] . The scope of technologies that hold persuasive potential is broader than ICT alone, and includes persuasive product design and architectural design, yet the interactive nature of computers uniquely enables user-sensitive and user-adaptive responding, allowing persuasive messages to be tailored to the specific user in question, presented at the right place and at the right time, thereby heightening their likely persuasive impact.

Persuasive technology has rapidly been gaining the attention of the HCI community, as is testified by the increasing number of publications in this area over recent years. However, to date, no international forum was exclusively devoted to provide a scientific platform for the specific cross-section of social psychology and computer science focused on the study of persuasive technology. PERSUASIVE 2006 was the first international conference entirely geared towards communicating the progress made in the area of persuasive technology, presenting recent results in theory, design, technology and evaluation.

In the PERSUASIVE 2006 conference, a particular emphasis was put on those applications that serve a beneficial purpose for humans in terms of increasing health, comfort, and well-being, improving personal relationships, stimulating learning and education, improving environmental conservation, et cetera. The conference aimed to bring together a number of different research fields, including, but not limited to, social psychology, HCI, computer science, industrial design, engineering, game design, environmental psychology, communication science, and human factors. In addition, we tried to appeal to people particularly active in areas such as health care delivery, education, civic affairs, and sustainability, as those areas related to human well-being were particularly targeted through this conference.

PERSUASIVE 2006 was organised as a two-day event with full papers, short papers, posters, and special sessions. The conference programme included two invited keynote speakers, B.J. Fogg from Stanford University, USA, and Johan Redström

---

[1] B.J. Fogg (1997). Captology: The study of computers as persuasive technologies. Conference on Human Factors in Computing Systems - CHI 97 Extended Abstracts, Atlanta, Georgia, USA, March 22-27, 1997.

[2] B.J. Fogg (2003). Motivating, influencing and persuading users. In: J.A. Jacko & A. Sears, The Human-Computer Interaction Handbook. Mahwah, NJ, LEA publishers.

from the Interactive Institute in Sweden. The programme was structured along the lines of the following three major themes:

- Psychological principles of persuasive technology
- Persuasive technology: Theory and modelling
- Persuasive technology: Design, applications and evaluations.

In addition, three special sessions were organised, highlighting topic areas that deserve particular attention in the context of persuasive technology:

- Ambient intelligence and persuasive technology
- Persuasive gerontechnology
- Ethics of persuasive technology.

The PERSUASIVE 2006 proceedings contain all accepted full and short papers, and some of the keynote and special session papers. The accepted papers were selected from the set of submitted papers through a carefully conducted review process, using blind peer-review. Each long paper received 3 reviews, each short paper at least 2. In cases of doubt (e.g., large variability between reviewers' opinions), two of the proceedings editors performed an additional review and debated the paper's strengths and weaknesses, after which a decision followed. We strongly believe this review process has resulted in a final set of accepted full and short papers that is of high quality and innovative value. We are greatly indebted to the members of the programme committee for their excellent work in reviewing the submitted papers and selecting the best papers for presentation at the conference and inclusion in the current LNCS volume. We note here that adjunct proceedings containing extended abstracts for posters were published separately.

PERSUASIVE 2006 was hosted by the Eindhoven University of Technology (TU/e), in Eindhoven, The Netherlands, as a joint effort between the Departments of Technology Management and Industrial Design, on May 18–19, 2006. We gratefully acknowledge the support from both these departments at TU/e, the JF Schouten School for Research in User-System Interaction, the Royal Netherlands Academy of Arts and Sciences (KNAW), SenterNovem IOP Human-Machine Interaction (IOP-MMI), the Rathenau Institute, and Philips. Moreover, we would like to thank all of those who supported the organisation of PERSUASIVE 2006 and who worked hard to make it a success, including Andrés Lucero, for designing the website and conference materials, our secretarial and logistics support, and student volunteers.

It is our hope that the conference helped to create common ground between the diverse areas that constitute this new and exciting research field. Moreover, we hope that this LNCS volume will contribute to the building of a community of scientists and designers that will direct their efforts towards the field of persuasive technology in the service of human well-being.

March 2006

Wijnand IJsselsteijn
Yvonne de Kort
Cees Midden
Berry Eggen
Elise van den Hoven

Organisation

Organising Committee PERSUASIVE 2006

Programme Chair:
Cees Midden (Eindhoven University of Technology)

Programme Vice-Chair:
Berry Eggen (Eindhoven University of Technology)

Organisers:
Wijnand IJsselsteijn (Eindhoven University of Technology)
Yvonne de Kort (Eindhoven University of Technology)

Treasurer:
Elise van den Hoven (Eindhoven University of Technology)

Graphics Design:
Andrés Lucero (Eindhoven University of Technology)

Sponsoring Organisations

Eindhoven University of Technology
Eindhoven University of Technology, Department of Technology Management
Eindhoven University of Technology, Department of Industrial Design
J.F. Schouten School for Research in User-System Interaction
Royal Netherlands Academy of Arts and Sciences (KNAW)
SenterNovem IOP Human-Machine Interaction (IOP-MMI)
Rathenau Institute
Philips

Scientific Review Committee

Mariano Alcañiz, Polytechnic University of Valencia, Spain
Jeremy Bailenson, Stanford University, USA
Gary Bente, University of Cologne, Germany
Frank Biocca, Michigan State University, USA
Don Bouwhuis, Eindhoven University of Technology, Netherlands
Tony Brooks, Aalborg University Esbjerg, Denmark
Prabu David, Ohio State University, USA
Kees Dorst, Eindhoven University of Technology, Netherlands
Arie Dijkstra, Groningen University, Netherlands
Berry Eggen, Eindhoven University of Technology, Netherlands

Brian Fogg, Stanford University, USA
Jonathan Freeman, University of London, Goldsmiths College, UK
Luciano Gamberini, University of Padua, Italy
Curt Haugtvedt, Ohio State University, USA
Elise van den Hoven, Eindhoven University of Technology, Netherlands
Wijnand IJsselsteijn, Eindhoven University of Technology, Netherlands
Stephen Intille, Massachusetts Institute of Technology, USA
Yvonne de Kort, Eindhoven University of Technology, Netherlands
Simone Maase, Eindhoven University of Technology, Netherlands
Panos Markopoulos, Eindhoven University of Technology, Netherlands
Judith Masthoff, University of Aberdeen, UK
Teddy McCalley, Eindhoven University of Technology, Netherlands
Anneloes Meijnders, Eindhoven University of Technology, Netherlands
Cees Midden, Eindhoven University of Technology, Netherlands
Beth Mynatt, Georgia Institute of Technology, USA
Johan Redström, Interactive Institute, Sweden
Boris de Ruyter, Philips Research, Netherlands
Timo Saari, Center for Knowledge and Innovation Research, Finland
Albrecht Schmidt, University of Munich, Germany
Peter de Vries, Twente University, Netherlands
Tamar Weiss, University of Haifa, Israel
Stephan Wensveen, Eindhoven University of Technology, Netherlands

Table of Contents

Persuasive Technology: Design, Applications and Evaluations

Ethics of Persuasive Technology

Persuasive Gerontechnology

Ambient Intelligence and Persuasive Technology

Persuasive Technology for Human Well-Being: Setting the Scene

Wijnand IJsselsteijn, Yvonne de Kort, Cees Midden, Berry Eggen, and Elise van den Hoven

Eindhoven University of Technology,
P.O.Box 513, 5600 MB, Eindhoven, The Netherlands
{w.a.ijsselsteijn, y.a.w.d.kort, c.j.h.midden, j.h.eggen, e.v.d.hoven}@tue.nl

Abstract. In this short paper we aim to give a brief introduction to persuasive technology, especially as it pertains to human well-being. We discuss a number of current research opportunities in areas of healthcare, environmental conservation, and education. We conclude by highlighting what we regard as the key research challenges that need to be addressed, focusing on context sensing and appropriate feedback, the need for longitudinal user studies, and ethical concerns.

1 Introduction

Persuasion is part and parcel of human interaction. From the serpent in the Garden of Eden to our modern mass-media society, persuasive efforts abound in a continuous attempt to influence our attitudes and behaviours, convincing us to spend money on one product rather than another, to vote for a particular political party, to stop smoking, to exercise more, to fight for environmental conservation, animal well-being, better schools. Or to eat an apple.

Since long, media technology has played a significant role in facilitating the delivery of persuasive messages to purchase, donate, vote, concede, or act – from megaphones to billboards to television. Technology becomes an especially powerful tool when it allows the persuasive techniques to be interactive rather than one-way, that is, altering and adjusting the pattern of interaction based on the characteristics or actions of the persuaded party – the user's inputs, needs, and context. This realisation has led to the investigation of *persuasive technology* [1,2], defined as a class of technologies that are intentionally designed to change a person's attitude or behaviour. Importantly, persuasion implies a *voluntary* change of behaviour or attitude or both. If force (coercion) or misinformation (deception) are used, these would fall outside of the realm of persuasive technology.

Humans are arguably the strongest persuaders. They have an unmistakable social presence and impact, can sense the appropriate timing, mood and context as opportunities for another person to be persuaded, and have a keen, mostly intuitive sense of the social psychological principles of persuasion, such as praise, reciprocation, similarity, or authority. However, as Fogg [2] points out, computers can

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 1 – 5, 2006.

have a number of distinct advantages over human persuaders. They can be more persistent (irritatingly so, in fact), they can allow anonymity (useful in cases where sensitive issues are at play), they can access and control a virtually unlimited store of data (retrieving exactly the right nuggets of information at the right time), and they can use many modalities (text, audio and video clips, rich graphics and animations, etc.) to create a seamless and convincing experience. Moreover, successful pieces of persuasive software can be easily replicated and distributed (addressing large numbers of people at the same time), and, with computers becoming increasingly ubiquitous and embedded, persuasive technology may gain access to areas where human persuaders would not be welcomed (e.g., bedroom, bathroom) or are physically unable to go (e.g., inside clothing or household appliances).

2 Persuasive Technology for Human Well-Being

Although the most frequent application of persuasive technology today is the use of computers to sell products and services, there is great beneficial potential in applying persuasive technologies to increase human health and well-being. The use of interactive technology in the health arena is still in its early stages, with e-care and tele-care programmes to extend healthcare into people's home environments not yet living up to their full potential. Arguably, one of the strongest areas of innovation for persuasive technology in the near future will be preventive health engineering.

Technological developments in ubiquitous computing and ambient intelligence allow for new opportunities in this area [3]. In particular, the development of new sensor technologies and algorithms that allow for context-aware computing, will make it possible to infer elements of a person's context and activity, and deliver appropriate persuasive health-related messages to that person *at the right time* when decisions are made or behaviour is executed, i.e., just-in-time messaging [4]. Moreover, the embedding of computational power and interactive displays in our everyday environment [5] as well as the ubiquity of mobile computing devices worn or carried by an increasing number of users, makes it feasible to provide persuasive feedback *at the appropriate place* where the user is likely to benefit most.

Technologies that motivate and support healthier lifestyle decisions related to diet, exercise, smoking, sexual behaviour, TV and internet use, stress management, and maintaining social relationships could delay or even prevent the onset of a variety of medical problems, and improve the quality of life. Potentially significant savings in healthcare costs, together with a shortage of medical and healthcare professionals, are likely drivers for insurance companies and healthcare providers to invest in this area. A number of early explorations are available, with more ambitious programmes currently being implemented (e.g., Intel, HP Labs, Philips). Examples include virtual fitness coaches for motivating workouts in healthy (though perhaps slightly overweight) adults [6, 7], QuitKey, a mobile application for helping people beat their smoking habit through cueing a gradual reduction programme [8], MyFoodPhone, which promotes healthy eating habits by keeping track of food intake and biometric data, and connecting to a nutrition coach who gives personalised feedback [9], or the recent use of social network visualisations as behavioural feedback displays, raising awareness of social connectedness as a dynamic and controllable aspect of well-being [10].

Furthermore, in the healthcare domain, a significant research effort is focused on gerontechnology, that is, technology in the service of healthy ageing. Motivated by trends in the world's demographics (i.e., increasing number of elderly people and increasing life spans), our basic need for autonomy, as well as constrained healthcare resources, technologies are investigated that will ensure the independence of the older adult and increase the quality of later life. Many of the challenges and problems of old age could be overcome by enduring life style or behaviour changes, such as dietary changes, exercise behaviour, or compliance to prescribed medication regimes. Other problems may be prevented through a continuation of already existing healthy behaviours, such as maintenance of an active social network and engaging in leisure activities. Persuasive technologies can have a positive, supportive role by convincing, stimulating or motivating adult users to engage in healthy behaviours, and instantly rewarding such behaviours when they occur [3, 11]. Paradoxically, in order to be effective, persuasive gerontechnology should perhaps not focus primarily on the older adult, but should start already much earlier in life, as trajectories leading to chronic diseases in later life (e.g., cardiovascular diseases, Alzheimer's disease) are severely influenced by one's lifestyle choices as a younger adult [3, 12].

In other areas of human well-being, such as education and environmental conservation, persuasive technology will also have a significant part to play. Here too, appropriate just-in-time notifications presenting relevant, actionable information *in situ* may prove to be very powerful tools in motivating people to adapt their behaviour. For example, direct feedback on energy consumption when turning the heater up, taking a shower or using a household appliance [13] can trigger a positive behaviour change. To raise environmental awareness and change energy use patterns, computer games such as PowerHouse [14] are also explored for their ability to provide information in a fun and rewarding way, creating an understanding of the relation between various domestic behaviours and household energy consumption. Given the huge success of computer games amongst children and adolescents, educators are currently looking at the opportunities for motivating learning experiences through the engaging interactivity and subtle reward structure of computer games, both inside and outside the classroom [15, 16].

3 Three Key Research Challenges

Although the first design explorations of persuasive technology show promising results, we would like to conclude this short paper by identifying three key research challenges that need to be addressed as persuasive technology matures. First, when applying context-sensing and inferences for just-in-time persuasive messaging, the benefits that such interventions will bring are crucially dependent on the quality and relevance of the machine sensing and inference algorithms. As the physical world and human behaviour are both highly complex and ambiguous, this is by no stretch of the imagination a solved problem. Most problematic will be attempts at inferring some internal human intent, requiring levels of intelligence even a human would find difficult to attain.

Second, human behaviour typically takes a long time to change. At present, to our knowledge, hardly any user studies are available that have looked at the long-term effectiveness of persuasive technology. Will the technology be perceived as subtle and non-irritating, or as bullying or patronising? What happens when we receive the same feedback not once or twice, but continuously, day in day out? How tolerant will we be to incorrect inferences, improper feedback, or bad timing? Will we remain motivated after we have stopped using the persuasive technology, removing the external incentives that influenced our behaviour? These and related issues need to be addressed in longitudinal, large-N user acceptance studies.

And finally, there is the need for a continuous and open ethical debate on the pros and cons of persuasive technology. As technological progress enables more subtle and effective persuasive techniques to be implemented, this will continue to pose new moral dilemmas. User-centred design of persuasive technology should explicitly include ethical guidelines [17], encouraging morally responsible design of persuasive technology and, of course, frowning upon the serpent in the Garden.

References

1. Fogg, B.J.: Persuasive technologies. *Communications of the ACM 42(5)* (1999) 27-29
2. Fogg, B.J.: Persuasive Technology. *Using Computers to Change What We Think and Do*. San Fransisco, Morgan Kaufman Publishers (2003)
3. Intille, S.S.: A new research challenge: Persuasive technology to motivate healthy aging. *IEEE Transactions on Information Technology in Biomedicine, 8* (2004) 235-237
4. Intille, S.S.: Designing a home of the future. *IEEE Pervasive Computing 1*, April/June (2002) 80-86
5. Aarts, E., Marzano, S.: *The New Everyday. Views on Ambient Intelligence*. Rotterdam, 010 Publishers (2003)
6. Davis, J.W., Bobick, A.F.: Virtual PAT: a Virtual Personal Aerobics Trainer. *Proc. of Workshop on Perceptual User Interfaces* (PUI'98), San Francisco, CA (1998) 13-18
7. IJsselsteijn, W.A., de Kort, Y.A.W., Westerink, J., de Jager, M., Bonants, R.: Fun and Sports: Enhancing the Home Fitness Experience. In: Rauterberg, M. (ed.), *Entertainment Computing - ICEC 2004*. LNCS, 3166, New York, Springer Verlag (2004) 46-56
8. http://www.quitkey.com/
9. http://www.myfoodphone.com/
10. Morris, M.E.: Social networks as health feedback displays. *IEEE Internet Computing 9(5)* (2005) 29-37
11. de Kort, Y.A.W., IJsselsteijn, W.A., Midden, C.J.H., Eggen, J.H., van den Hoven, E.A.W.H.: Persuasive gerontechnology. *Gerontechnology 4* (2005) 123-127
12. Morris, M.E.: Biofeedback revisited: Dynamic displays to improve health trajectories. In: IJsselsteijn, W.A., de Kort, Y.A.W., Midden, C.J.H., Eggen, J.H., van den Hoven, E.A.W.H. (eds.), *PERSUASIVE 2006*. LNCS, 3962, New York, Springer Verlag (2006) 207-214
13. McCalley, T., Kaiser, F., Midden, C.J.H., Keser, M., Teunissen, M.: Persuasive appliances: Goal priming and behavioural response to product-integrated energy feedback. In: IJsselsteijn, W.A., de Kort, Y.A.W., Midden, C.J.H., Eggen, J.H., van den Hoven, E.A.W.H. (eds.), *PERSUASIVE 2006*. LNCS, 3962, New York, Springer Verlag (2006) 45-49

14. Bang, M., Torstensson, C., Katzeff, C.: The PowerHouse: A persuasive computer game designed to raise awareness of domestic energy consumption. In: IJsselsteijn, W.A., de Kort, Y.A.W., Midden, C.J.H., Eggen, J.H., van den Hoven, E.A.W.H. (eds.), *PERSUASIVE 2006*. LNCS, 3962, New York, Springer Verlag (2006) 123-132
15. http://www.seriousgames.org/
16. Lucero, A., Zuloaga, R., Mota, S., Muñoz, F.: Persuasive technologies in education: Improving motivation to read and write for children. In: IJsselsteijn, W.A., de Kort, Y.A.W., Midden, C.J.H., Eggen, J.H., van den Hoven, E.A.W.H. (eds.), *PERSUASIVE 2006*. LNCS, 3962, New York, Springer Verlag (2006) 142-153
17. Berdichevsky, D., Neuenschwander, E.: Towards an ethics of persuasive technology. *Communications of the ACM 42(5)* (1999) 51-58

The Six Most Powerful Persuasion Strategies

B.J. Fogg

Abstract. For thousands of years humans have used about 60 persuasion strategies to influence others. Six of these strategies are especially powerful when designed into computing products—from websites to mobile phones applications.

We gain insights into the potentials and pitfalls of persuasive technology through examples of the six persuasion strategies in today's high-tech products. We gain understanding of these strategies--and our own human nature--by mapping out key psychological dimensions related to user experience.

As we get better at changing beliefs and behaviors with technology, we also must examine the ethical implications of creating machines that shape humans, communities, and society.

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, p. 6, 2006.

Changing Induced Moods Via Virtual Reality

Rosa María Baños[1], Víctor Liaño[1], Cristina Botella[2], Mariano Alcañiz[3], Belén Guerrero[2], and Beatriz Rey[3]

[1] Departamento de Personalidad Universidad de Valencia. Avda. Blasco Ibañez, 21, 46010-Valencia, Spain
[2] Departamento de Psicología. Universidad Jaume I. Campus de Borriol, 1280-Castellón, Spain
[3] Medical Image Computing Laboratory. Universidad Politécnica de Valencia. Camino Vera s/n 46022-Valencia, Spain

Abstract. Mood Induction Procedures (MIPs) are designed to induce emotional changes in experimental subjects in a controlled way, manipulating variables inside the laboratory. The induced mood should be an experimental analogue of the mood that would occur in a certain natural situation. Our team has developed an MIP using VR (VR-MIP) in order to induce different moods (sadness, happiness, anxiety and relaxation). The virtual environment is a park, which changes according to the mood to be induced. This work will present data about the efficacy of this procedure not only to induce a mood, but also to change after the mood is induced.

1 Introduction

This study was conducted in the framework of the EMMA project (IST-2001-39192). The main objectives of this project were to study the relationships between the sense of presence users feel in virtual environments and the emotions experienced by the users. In order to do that, EMMA's specific purpose was focused on designing Mood Induction Procedures (MIP), using Virtual Reality (VR-MIP), and to test the efficacy of these procedures.

MIPs can be defined as "strategies whose aim is to provoke in an individual a transitory emotional state in a non natural situation and in a controlled manner; the mood induced tries to be specific and pretends to be an experimental analogue of the mood that would happen in a certain natural situation" (p. 16) [1]. Mood has emerged as an important influence in conceptions of human behavior and cognition .The experimental study of the influences of mood and affect requires the induction of positive and negative mood experiences to determine their effects [2]. Studies that test the effects of MIPs offer valuable information regarding the connections between emotion, behavior and thought processes [3].

A number of methods for inducing positive and negative mood states have been proposed, and the most widely used are [2] [4]: Self-statements or Velten procedure, music, music "in crescendo", hypnotic suggestion, facial expression,

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 7–15, 2006.

game feedback, social feedback, autobiographical recall, social recall, imagery, empathy, experimenter behaviour, films, threat, public speaking, gift, drugs, social interaction and a combination of MIPs. We have selected four of them:

- "Self-statements or Velten procedure": This was developed by Velten [5]. The induction is achieved by means of 60 statements relative to the mood, written in first person. Subjects are asked to read the statements, and to try to feel a mood similar to the one described in the statement.
- "Music": This was first used the by Sutherland, Newman and Rachman [6]. Subjects are asked to use the music piece as a base for entering themselves into a mood. They are told that music alone can't induce the mood automatically and that they must follow their own strategies to achieve the mood.
- "Autobiographical recall": This was developed by Brewer, Doughtie and Lubin [7]. Subjects are asked to remember autobiographical events that provoke a certain mood in them, e.g. one that makes them feel alone, rejected, frustrated or hurt.
- "Films" (or fragments of films): These have been used by Gross' group [8]. Subjects are asked to feel all the emotions provoked by the film as intensely as possible, without trying to console themselves or hide their feelings.

All of these experimental procedures have been used in many research studies with different purposes, and they have shown to be effective in inducing the target mood. However, manipulating mood states in the laboratory has proven challenging. There is some criticism regarding the validity and empirical verification of some of these MIPs [4], including the possibility of demand effects, success rate, the intensity of the induced mood, the range of different moods that can be induced and the specificity of the induced mood.

Regarding demand effects, it has been suggested that participants do not truly change their mood but report as if they did, merely to satisfy the researcher's expectations. However, research on this topic has concluded that although the demand effects may inflate the induction effect size, the induction effects continue to be significant.

Regarding success rate, there is considerable variability when different MIPs are taken into account. Generally speaking, it appears to be easier to induce a sad mood than an elated one [2] [3] [4]. This may be because participants, (i.e. the general population), are usually not depressed, but rather happy to some extent; therefore, it is more difficult to enhance this positive mood than to increase negative emotions.

Regarding the intensity of the induced mood, several criteria have been used to assess it. One is how long the induction effects last. Some studies point out that 10-15 minutes is the maximum [9]. Another criterion is to compare the experimentally induced moods with people suffering from a mood disorder as depression. MIPs may provoke a negative mood equivalent to a intermediate clinical level, but only during the intensity of this very transitory mood [10] [11] [12].

Regarding the range of different moods that can be induced, there is also a great variability, as some MIPs only can be used to induce a single mood [2].

For instance, MIPs that invoke stress or anxiety often do not have variations for inducing positive or neutral moods, thereby hindering comparisons across multiple moods. Likewise, inducing a neutral mood in the laboratory has proven particularly challenging [13]. In aggregate, past studies incorporating mood induction illustrate the difficulty of finding one manipulation capable of inducing all mood states (i.e., negative, positive, and neutral), as well as robust induced moods [14].

Finally, regarding the specificity of an induced mood, it is not possible to accurately gauge, because it is not clear if "pure" moods occur even in natural situations.

Thus, there are still many unanswered questions in the MIP field; VR technology could be useful in overcoming some of them. VR has many possibilities because it is an immersive and interactive tool. Firstly, it could increase the ecological or external validity of the mood induction, since thus far these procedures have been applied only inside the laboratory. VR allows controlling the variables, without compromising the methodological rigor that the laboratory offers, while locating the person in an environment very similar to the natural one. Furthermore, this "ecological" environment can induce a broad range of moods with the same elements, not only one specific mood.

As has been mentioned, the EMMA project (IST-2001-39192) has developed an MIP using VR (VR-MIP) to induce four different moods in users (sadness, joy, anxiety and relaxation). A neutral condition was also included, where no changes in mood were expected. The efficacy of this VR-MIP has been tested previously [15], wherein data showed that this procedure was able to induce the target moods in users. Furthermore, VR-MIP was compared with a traditional MIP in which the same procedures were used (Velten sentences, movies, pictures and music) although without the mediation of the virtual environment (but rather imagination). Results [16] showed differences between subjective sense of presence in virtual and imagery environments. Participants in the imagery space (traditional MIP) informed a high sense of presence at the beginning of the procedure, but a decrease was observed. At the end of the mood induction they informed a low sense of presence. However, participants in the virtual space (VR-MIP) showed the opposite pattern: their subjective sense of presence increased throughout the virtual experience.

The present study investigates the potential of using VR not only to induce positive and negative effect, but also to change an induced mood (sadness) into the opposite one (that is, happiness). So far, there is little evidence that any MIP retains its efficacy across repeated administrations. This issue would open many potential applications for therapy.

2 Method

2.1 Participants

The sample was composed of 110 university student volunteers (40 men and 70 women). Their age range was from 18 to 49. Before the experiments, all

participants were screened using an interview and several questionnaires in order to detect any of the following exclusion criteria: history of neurological disease, head injury, learning disability or mental disorder, history of psychological disorders, use of any medication for psychological or emotional problem, or scoring 18 or higher in BDI (Beck Inventory Depression) [17].

2.2 Experimental Design

An intra-subjects design using repeated measures was used. A standard MIP was used, in which we measured the subjective mood at different moments during MIP (before and after the sadness induction and before and after the happiness induction).

2.3 Measures

- Visual Analogue Scale (VAS): A variation of the original measure [8] was used. Participants were asked to rate on a 1-7 points Likert Scale (1 = Not feeling the emotion at all, 7= Feeling the emotion extremely), how they felt at that moment in every one of the following emotions: sadness, joy, anxiety and relaxation.
- Positive Affect Negative Affect Schedule (PANAS) [18]. This is a list of 20 adjectives used to describe different feelings and emotions: 10 positive moods/emotions and 10 negative moods/emotions. Subjects must indicate if they feel these emotions in that moment with a 1-5 points scale (1= very slightly or not at all, 5 = extremely).

2.4 Virtual Environment (VR-Mood Induction Procedures)

The virtual environment consists of a neutral environment that changes depending on the mood state that we want to evoke in the user. The chosen scenery was a park, because it is an environment where natural elements are present (trees, flowers, water, etc...)By changing some light parameters (tone, direction, brightness) it is possible to modify the aspect of the environment resulting in a set of different moods in the user (see Figures 1 and 2). In order to build the different environments, variations of every one of the following elements were included: music[1], Velten self-statements, [5] plus pictures (selected from International Affective Picture System IAPS, [19]), movies [8], and autobiographical recalls [7]. A previous study [15] has proved that this MIP is able to induce different moods in users. Data from subjective mood state measurements showed that the four emotional environments (sadness, joy, anxiety and relaxation) were able to produce mood changes in the users.

The VR-MIP was as follows: Users listened to a short history according to the emotional condition (sadness, happiness, anxiety and relaxation). A woman's voice guided users through a virtual walk. From the beginning, a piece of music was heard [1]. The initial appearance of the environment was the same for all users. However, the aspect soon changed depending on the intended emotional

condition (see Figures 1 and 2). Users had two minutes to freely explore the park. Then, they were asked to go to the center of the park, where a bandstand was located. On five sides of the stand (it is an eight-faced polyhedron), a different statement of the Velten [5] technique appeared in a disordered manner; users had to order it. The content of the statements depended on the emotional condition. For each sentence, users had to choose a picture from four options which best represented the meaning of the sentence for them. All pictures were selected from IAPS [19]. Users were asked to get involved in the contents of each sentence for 45 seconds, to think about the personal meaning of each statement. After that, they could again walk around the virtual park for two more minutes. Then, users were asked to go to the cinema to watch a short film [8]. Once the cinema session was finished, users were asked to relate in a loud voice a personal recollection reminiscent of the things that happened in the park.

Fig. 1. Band stand in the sad park

Fig. 2. Band stand in the happy park

2.5 Hardware Devices

As an open immersive display we used a metacrilate retro-projected screen of 400x150 cm. The retro-projection option allowed the user to walk near the screen without blocking the image and projecting shadows on the screen. Projectors had a resolution of 1024x768 pixels and a power of 2000 lumens. However, we regulated them for a power of 1000 lumens for the comfort of the user. The interaction device was a Wireless Pad.This device has two special features; it has no wires so the user can move and stand (in front of the big screen, for example), and it has two small joysticks: one is used to navigate and the other to interact.

2.6 Procedure

The experimental session started with participants filling in some questionnaires and answering some questions in order to verify exclusion-inclusion criteria. Then, participants entered a room containing the virtual system. With the help of an experimenter, the user practised moving and interacting with virtual objects in a brief training environment. Next, participants filled in the pre-induction VAS and PANAS measures and they remained alone in the room. Then, the virtual session started. It took 30 minutes to complete the virtual walk, after which subjects filled in emotion measurements (VAS, PANAS) and other questionnaires and attentional tasks not used in the present study (lasting about 15 minutes). Then, they were invited to walk around the park again, this time with positive (happy) content. Before entering into the happy park, participants again filled out the pre-induction VAS and PANAS measures. It took 30 minutes to complete this second virtual walk. When the experience finished, users again filled out the VAS and the PANAS.

2.7 Results

Regarding VAS measure, means and standard deviations can be found in Table 1 and Figure 3. Students' t tests (paired samples t: pre-induction versus post-induction comparisons) were conducted on the mood measures and all analysis showed statistic differences, indicating that both inductions (sadness and happiness) were effective. Participants changed their moods in the expected directions, decreasing positive moods and increasing negative ones in the sad induction, with the opposite pattern for the happy induction

2.8 Discussion

Regarding the hypothesis, our results point out that VR-MIP is not only effective in inducing a target mood (sadness), but also in changing this induced mood to the opposite emotion (happiness). Data from subjective mood state measurements show that the emotional virtual environments (sad and happy) are able to produce mood changes in the users. There are still many unanswered questions

Table 1. VAS scores (before and after the two mood inductions): Means and (standard deviations) ratings

	Pre-Sad induction	Post-Sad induction	Pre-Happy induction	Post-Happy induction
VAS-hapiness	4.54 (0.937)	3.00 (1.206)	3.93 (1.091)	5.30 (0.892)
VAS-sadness	1.77 (0.908)	4.11 (1.421)	2.65 (1.316)	1.61 (0.860)
VAS-anxiety	2.45 (1.058)	2.40 (1.326)	1.76 (1.038)	1.48 (0.886)
VAS-relax	4.28 (1.155)	3.99 (1.374)	4.26 (1.237)	4.90 (1.150)

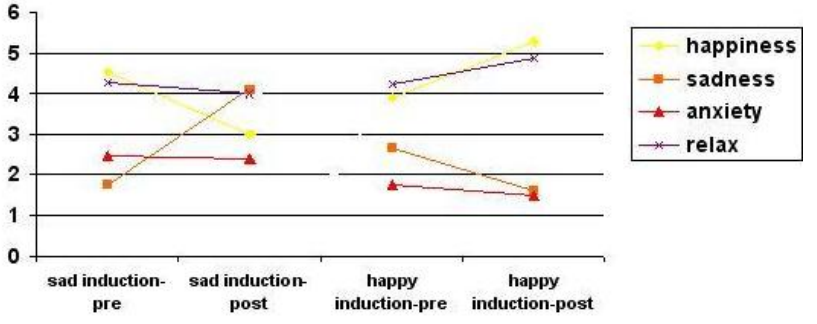


Fig. 3. VAS scores before and after the two mood inductions

Table 2. PANAS scores (before and after the two mood inductions): Means and (standard deviations) ratings

	Pre-Sad induction	Post-Sad induction	Pre-Happy induction	Post-Happy induction
Positive Mood-PANAS	30.65 (7.37)	24.96 (8.40)	24.75 (7.40)	32.05 (8.00)
Negative Mood-PANAS	13.29 (3.48)	14.73 (4.83)	15.73 (4.93)	11.61 (2.78)

that only future research could clarify. For instance, an important question is: how long do induced moods last, and to what extent are they transitory? These results are important since they reveal the utility of the VR-MIPs as mood devices and, therefore, the possibility of using them in the future from both an applied and experimental perspective.

We believe that this procedure which experimentally alters emotional states has important research and clinical applications. Regarding basic research, mood induction has been a cornerstone of research on experimental Psychopathology. Research on emotion, affect and mood is absolutely necessary to understand human behavior and, as has been mentioned, MIPs are useful procedures for experimentally studying the influence of affect and mood [4]. The results of this study contribute to the literature on MIPs, offering an alternative method for inducing mood. We have shown that VR-MIP can reliably produce desired affective states. Regarding clinical applications, this VR-MIP could also be used

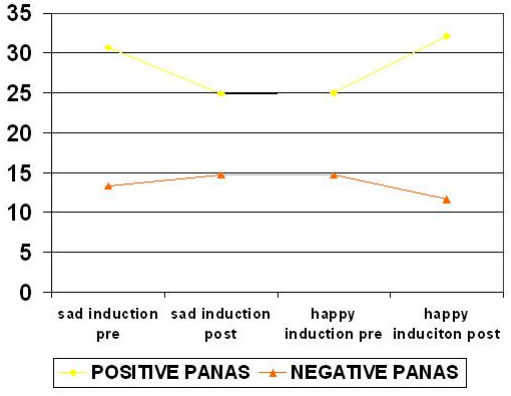


Fig. 4. PANAS scores before and after the two mood inductions

as a therapeutic tool for inducing specific moods (relaxation or happiness) in people who need mood modification. In conclusion, our results indicate that the "new technologies" are useful for creating devices that are able to induce and change emotions in the users. However, further investigation is needed, especially regarding objective measures.

Acknowledgments

This research was funded through the EMMA project (IST-2001-39192), funded by the European Community: V Framework Programme (IST Programme, 8th call, "Future and Emerging Technologies."

References

1. García Palacios, A., Baños, R. (1999). Eficacia de dos procedimientos de induccin del estado de nimo e influencia de variables moduladoras. Revista de Psicopatologa y Psicologa Clnica., 4 (1), 15-26.
2. Martin, M. (1990). On the induction of mood. Clinical Psychological Review., 10, 669-697.
3. Gerrards-Hesse, A., Spies, K., Hesse, F. W. (1994). Experimental inductions of emotional states and their effectiveness: A review. British Journal of Psychology, 85, 55-78.
4. Westermann, R., Spies, K., Stahl, G., Hesse, F. (1996). Relative effectiveness and validity of mood induction procedures: a meta-analysis. European Journal of Social Psychology, 26, 557-580.
5. Velten, E. (1968). A laboratory task for induction of mood states. Behaviour Research and Therapy, 6, 473-482.
6. Sutherland, G., Newman, B., Rachman, S. (1982) Experimental investigations of the relations between mood and intensive unwanted cognition. British Journal of Medical Psychology, 55, 127-138.

7. Brewer D., Doughtie E.B., Lubin B. (1980). Induction of mood and mood shift. Journal of Clinical Psychology, 36, 215-226.
8. Gross, J.J., Levenson, R.W. (1995). Emotion elicitation using films. Cognition and Emotion, 9, 87-108.
9. Frost, R.O., Green M.L. (1982). Duration and post-experimental removal of Velten mood induction procedure effects. Personality and Social Psychology Bulletin, 8, 341-347.
10. Clark, D, M., Teasdale, J.D. (1982). Diurnal variation in clinical depression and accessibility of memories of positive and negative experiences. Journal of Abnormal Psychology, 91, 87-95.
11. Clark, D, M., Teasdale, J.D. (1985). Constraints of the effects of mood on memory, Journal of Personality and Social Psychology, 48, 175-178.
12. Clark, D.M. (1983). On the induction of depressed mood in the laboratory: Evaluation and comparison of the Velten and musical procedures. Advanced Behavior Research and Therapy, 5, 27-49.
13. Hufford, M. R. (2001). An examination of mood effects on positive alcohol expectancies among undergraduate drinkers. Cognition and Emotion,15, 593-613.
14. Conklin, C.A., Perkins,K.A. (2005) Subjective and Reinforcing Effects of Smoking During Negative Mood Induction Journal of Abnormal Psychology, 114, 153-164.
15. Baños, R.M.; Botella,C.; Guerrero, B.; Liaño, V.; Rey, B.; Alcañiz, M. (2004) Sense of Presence in Emotional Virtual Environments Presented at PRESENCE 2004 - 7th Annual International Workshop on Presence 13-15 October 2004 Valencia, Spain.
16. Baños, R.M.; Botella,C.; Guerrero, B.; Liaño, V.; Alcañiz, M. Rey, B.; (2005) The third pole of the sense of presence: Comparing virutal and imagery sapces. PsychNology Journal 3 (1) 90-100.
17. Beck, A.T., Ward, C.H., Mendelson M., Hock J., Erbaugh J. (1961). An inventory for measuring depression. Archives of General Psychiatry, 4, 561-571.
18. Watson, D., Clark, L. A., Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. Journal of Personality and Social Psychology, 54, 1063-1070.
19. Lang P.J., Bradley M.M., Cuthbert B.N. (1995). International Affective Picture System (IAPS): Technical Manual and Affective Ratings. NIMH Cent. Study Emot. Atten., Univ. FL.

Technology Adds New Principles to Persuasive Psychology: Evidence from Health Education

Arie Dijkstra

University of Groningen, Social and Organizational Psychology,
Grote Kruisstraat 2/1, 9712 TS, Groningen, The Netherlands
a.dijkstra@ppsw.rug.nl

Abstract. Computer-technology has led to the use of new principles of persuasion. These new principles constitute the unique working mechanisms of persuasion by means of computer. In the present study, three tailored messages that each contained one potential working mechanism - personalization, adaptation or feedback - were compared with a standard information condition. Two hundred and two students who smoked tobacco daily were randomly divided over four conditions. After the computer pre-test questionnaire, they read the information in their condition and filled in the immediate post-test. After 4 months, they were sent a follow-up questionnaire assessing their quitting activity. The data show that personalization (44.5%) and feedback (48.7%) but not adaptation (28.6%) led to significantly more quitting activity after 4 months than did the standard information (22.9%). Moreover, the effect of condition on quitting activity was mediated by individuals' evaluations of the extent to which the information took into account personal characteristics.

1 Introduction

Advances in computer-technology have expanded the possibilities to persuade people using text. Of all the possibilities that computers offer, increasing the personal relevance of a text by directly or indirectly incorporating information that was provided by the individual into the text, opens new perspectives in persuasion. Although all the possibilities of increasing the personal relevance of a text were available since humans write texts and letters, computers have opened the possibility to apply the possibilities on a large scale. In addition, because computers are now used widely, this "tailoring of information" is used more and more in society, for example in the domain of health.

The tailoring of information to individual characteristics to enhance effectiveness may be a large step forward in the field of health education [1,2,3,4]. During the last ten years, many studies have been conducted to show the superiority of tailored materials over standard materials. Several studies show that tailored information is more effective than existing standard materials. However, in most of these studies, tailored and non-tailored materials were used that not only differed in the extent to which they took individual characteristics into account, but also differed in the type of information given, the amount of information, and the lay-out [5]. Few studies have

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 16 – 26, 2006.

been undertaken in which tailored materials were compared with similar but non-tailored materials. Only such studies can show whether the tailoring of information is a fundamental step forward in persuasion. The results of these well-controlled studies are mixed. Some found that tailoring was more effective [6,7]; others found no difference [8, 9]; while other researchers found interaction effects [10, 11], meaning that tailored information was effective only in subgroups of the examined samples. Therefore, the state of the art is that tailored information *can* be more effective than non-tailored information.

To further develop tailored materials, their working mechanisms must be identified. That is, the working mechanisms are responsible for the sometimes superior efficacy of tailored materials, and further shaping and testing of the working mechanisms may lead to more effective tailored materials. Although several researchers of tailored health information have hypothesized on the working mechanisms and the psychological mechanisms involved, to the best of our knowledge, no studies have been designed and published in which working mechanisms were explicitly theorized on.

The present study was designed to enhance our understanding of the sometimes superior effects of tailored communications from two perspectives: the characteristics of the tailored information and the psychological processes involved. Different working mechanisms and psychological processes have been proposed in the literature [7; 3; 8]. In the present study, the structure of characteristics of tailored communications as proposed by [8] was refined. In tailored communications, three potential working mechanisms are distinguished: personalization, adaptation and feedback. Personalization refers to incorporating recognizable aspects of a person in a general text. The recognizable feature or set of features refers undeniably to the person: for example, the person's first name or the combination of objective behavioral features such as the number of cigarettes smoked, the number of years the person smoked and the brand smoked. While, in personalization, specific features are mentioned in a text with general content, adaptation of information refers to adaptation of the content of the text itself. By adapting a text to a person's relevant characteristics, such as socio-demographic characteristics or the person's intention to change, the content information may become more relevant and less redundant. For example, a persuasive text for a smoker with small children may differ from that for a smoker without children. Similarly, the information offered to a smoker with low motivation to quit may differ from the information offered to a smoker with high intention to quit. The remaining working mechanism, feedback, refers to the provision of information about a person's state of which the person him- or herself may not have been (fully) aware [12]. For example, people may not be aware of the psychological denial they use to lower their anxiety for physical consequences. If the denial can be assessed, this information may be provided as feedback. In attempts to lower fat consumption, feedback on actual fat consumption has been proven to be of major importance [13].

In the present study, the "self-referent encoding" of information is used as the primary explanation. That is, the working mechanisms are thought to induce a process of "self-referent encoding". We assume that a latent scan of all environmental stimuli - including offered information – operates, which is focused on identifying self-relevant stimuli. If a stimulus is identified as being relevant for or referring to the self, the process of self-referent encoding of the information is started. Self-referent encoding refers to the interpretation and coding of external information against the background of

the self. Self-referent encoding comprises a deeper and richer processing of information in which the information is more actively compared with the person's own previous experiences, which comprise the self [14]. Self-referent encoding has been shown to enhance recall of offered information in several studies [15]. Personalization and feedback are thought to contain cues that trigger a process of self-relevant encoding. The extent to which adapted information is interpreted as being relevant for the self is thought to depend on the person's involvement in the issue. That is, in the case of low involvement with the topic of the tailored information, the adapted information can be discarded because it does not explicitly or undeniably refer to the self.

In the present study, we used a self-report measure of self-referent encoding. We argue that, during the reading of a tailored message, the extent of the self-referent encoding is experienced as the extent to which the information matches or takes into account the self. In several studies, tailored communications were rated as significantly more personal or as better taking into account the individual's situation [6,7,8,13]. Moreover, [8] showed that the extent to which the information was experienced as personal was significantly related to behavioral change. In the present study, we expected that the extent of self-referent encoding would mediate the effects of the working mechanisms on cognitive and behavioral changes.

2 Method

2.1 Participant Recruitment and Characteristics

Students who were daily smokers were recruited in the Faculty of Social Sciences by two means. Firstly, students could register their phone numbers on forms distributed in the lounge of the faculty. They later were phoned to make an appointment to come to the lab. About half of the participants in this study were recruited using this procedure. Secondly, students in the faculty lounge were asked to participate in the study immediately; no students refused to join the study.

Students were told that the study concerned the evaluation of a text that was to be used in a new brochure on smoking and smoking cessation. Participants would earn €5 and when they completed the four months follow-up assessment they had the chance of winning one of 4 bonus prizes amounting to €25.

Two hundred and two students participated in the study of whom 59% was female and the mean age was 22.2 years (SD=6.5). On average, the students had smoked for 5.8 years (SD=6) and they smoked 13 cigarettes a day (SD=7.4). The mean score on a measure of intention to quit smoking in the following six months with a 7-point scale was 3.2 (SD=1.92).

2.2 Procedure

On arrival in the lab, participants were registered, and they were asked to take a place in a cubical room and to follow the instructions on the personal computer. The pre- and posttests and the (tailored) texts were programmed in Authorware 4 (MacroMedia). After three screens of short instructions, the pretest assessment was conducted. Following this, the participants were exposed to the information in the condition they were randomly assigned to. After reading the text, the participants

were directed to the posttest assessment. After the posttest, the program indicated that the study was over. The participants filled in a form to receive their financial compensation and they were asked whether they agreed to receive a follow-up questionnaire after four months. They were informed that completion of the follow-up assessment would earn them a chance to win one of 4 bonus prizes of 25 euro. All participants agreed to this and registered their names and addresses. Of the 202 lab participants, 141 (70%) returned the follow-up questionnaire four months later.

2.3 Experimental Conditions

Participants were randomly assigned to one of four conditions (Table 1). In all conditions the information that was offered comprised four screens of information of about 200 words each.

STAN condition. The STAN condition (n=51) offered the standard non-tailored information. In the three tailored conditions, this information was tailored in three different ways. The information in the STAN condition consisted of four texts. The first text was about the long-term serious negative health consequences of smoking, the second text offered information on the short-term negative physical consequences of smoking, the third text was on the negative social consequences of smoking, while the fourth text dealt with the negative self-evaluative consequences of smoking.

PERS condition. The PERS condition (n=50) offered the same text as did the STAN condition, but it incorporated four recognizable personal features in the text. In the text on the first screen, the individual number of cigarettes and the type of cigarettes a participant smoked (cigarettes with or without filter or hand-rolled cigarettes) were mentioned. In the second text, a person's first name and the number of years he or she had smoked were mentioned once. In the third text, only a person's first name was mentioned once, while, in the fourth text, a person's first name was mentioned twice.

ADAP condition. In the ADAP condition (n=51), the information was adapted to certain individual features but the texts were written as if they were meant for a general audience. For females, the text on the first screen offered information on the long-term consequences of smoking specifically in women (n=32). Males were offered information specifically about the consequences in men (n=19). If the participant indicated at the pretest that he or she took part in sport weekly, the second text dealt with the short-term negative consequences of smoking in general for sports accomplishments (n=19). Otherwise, the text was not about physical activity but tried to focus the attention on bodily symptoms of smoking such as cough and dizziness (n=32). If the participant indicated at the pretest that non-smokers "regularly" or "often" inhaled their secondary smoke, the third text offered general information on the effects of passive smoking and the inconvenience to non-smokers (n=29). Otherwise, the text did go into passive smoking but argued that the perception of smoking was changing in society (n=22). If the participant indicated at the pretest that he or she would not evaluate him- or herself more positively if he or she stopped smoking, the fourth text argued that smokers are often defensive when persuasive attempts are made to encourage them to stop smoking and that they therefore often use excuses to smoke (n=38). If the participant indicated that he or she would evaluate him- or herself more positively if he or she stopped smoking, the text was about how

painful feelings of shame and dissatisfaction with oneself can be, and how strong the relief is in the case of quitting (n=13).

FEED condition. The FEED condition (n=50) added one or two sentences of personal feedback on the basis of pretest scores before the non-tailored information was provided (while removing the first one or two introductory non-tailored sentences). In the text on the first screen, individual feedback (two possible feedback messages) was added on the participants' awareness of the serious dangers of smoking on the basis of a pretest item that assessed the expected long-term consequences (e.g. "It appears from your responses to the questionnaire that you underestimate the dangers of smoking"). In the second text, individual feedback (three possible feedback messages) was added on experienced symptoms attributed to smoking on the basis of 1) a pretest item that assessed the frequency with which participants experienced smoking-related symptoms; 2) the number of cigarettes smoked a day (e.g., "You hardly notice from the reactions of your body that you are smoking. This might be because you are not a heavy smoker. However,…."). In the third text, individual feedback (two possible feedback messages) was added on the participants' high or low awareness of the increasingly negative views of smoking on the basis of shame for smoking assessed at the pretest (frequent shame indicated high awareness; e.g., "From your answers, it seems that you barely perceive that smoking is viewed increasingly negatively"). In the fourth text, individual feedback (four possible feedback messages) was added on having or not having a biased view of the consequences of smoking in order to regulate negative emotions. This was done on the basis of an excuses score and the reported positive self-evaluation in the case of quitting (e.g., "From the questionnaire, it seems that you are so dissatisfied with yourself because you smoke that you try not to think about it").

2.4 Measures

In the pretest, the following variables were assessed for psychometric use. Smoking behaviour was assessed in terms of the number of years smoked and the number of cigarettes smoked per day. The demographic information assessed concerned gender and age. Intention to quit was assessed in the following way. Smokers were asked to indicate the plan that best described their own plans with regard to their smoking behaviour. The categories were "I am planning to quit within 30 days" (1); "I am planning to quit within 6 months" (2); "I am planning to quit within 12 months" (3); "I am planning to quit within 5 years" (4); "I am planning to quit within 10 years" (5); "I am planning to quit sometime in the future but not within 10 years (6); "I am planning to keep on smoking but to cut down" (7); "I am planning to keep on smoking and not to cut down" (8). Self-efficacy was assessed using three items on 7-point scales on the difficulty of quitting smoking, on being able to quit smoking, and on the perception that a person can quit smoking (α=.76). Because the participant's state of arousal could affect the reactions towards the information offered in the conditions, the present state of arousal was assessed using four items on 7-point scales: "How nervous do you feel at this moment?"; "How relaxed do you feel at this moment?"; "How unsure do you feel at this moment?"; and "How calm do you feel at this moment?". The mean item score was used as the scale score (α=.81). The following post-test variables were assessed immediately after the participants had read the information. The main outcome measure was the attitude towards smoking. Attitude was assessed using eight items on 7-point

scales. Principal component analyses showed two clearly separate factors which we called affective attitude towards smoking (α=.78) and cognitive attitude towards smoking (α=.80). The affective attitude scale was composed of two items: "I find smoking": very unpleasurable (1)/very pleasurable (7); very untasteful (1)/very tasteful (7)". The cognitive attitude scale was composed of four items: "I find smoking": bad (1)/good (7); stupid (1)/smart(7); very unwise (1)/very wise (7); totally safe (1)/ very dangerous (7). Two sets of information-evaluation measures were used. The first set concerned four items on the general message evaluation on 7-point scales: "Did you find the information reliable?"; "Did you find the information difficult to understand?"; "Did you find the information interesting?"; and "Did you find that the information was honest?". The second set of evaluation items concerned the tailoring-evaluation items. These items were expected to be related to the extent of the self-referent encoding of the information: "Was the information directed to you personally?"; "Did the information take into account your personal situation as a smoker?"; "Did you recognize your own opinion in the information?"; and "Did the information take into account who you are?".

To assess quitting activity at the four-month follow-up, a single measure of quitting activity was composed indicating "any quitting activity" (1) or "no quitting activity at all" (0). Four items were used to assess quitting activity: A "no" in response to the questions 1) "Did you smoke at all since you were in the lab?"; 2) "Did you smoke during the last seven days?" or; 3) "Did you smoke during the last thirty days?" was coded as quitting activity. Furthermore, a "yes" in response to the question: 4) "Did you make an attempt to quit since you were in the lab?", was coded as quitting activity. No biochemical verification of the self-reported quitting behavior was conducted, for three reasons. Firstly, the announcement of biochemical verification could be expected to increase non-response and dropout. Secondly, with regard to the questions 1) and 4), no biochemical validation is possible. Thirdly, the present study can be classified as placing "low demands" on the participants; hence, their self-reported smoking behavior was considered to be sufficiently valid (see Velicer, Prochaska, Rossi, & Snow, 1992).

2.5 Randomization and Attrition

A randomization check was conducted by comparing individuals in each condition in respect of gender, age, number of cigarettes smoked a day, number of years the individuals smoked, intention to quit, self-efficacy, and arousal assessed at the pretest. The results showed that the conditions differed significantly in respect of the number of years the individuals smoked and age. However, neither variable had significant relations with any of the outcome measures ($p>.25$). The characteristics of the participants who did not return the four-month follow-up questionnaire were compared with those of the participants who did in respect of the pretest variables. The results showed that the group that failed to return the follow-up questionnaire comprised a significantly larger number of males, and that members of this group had smoked for significantly fewer years. Again, neither variable was related to the follow-up outcome measure, quitting activity.

2.6 Statistical Analyses

To tests the effects of Condition on quantitative outcome measures, analyses of variance were used. To test the effects of Condition on the dichotomous outcome measure

"Quitting activity", logistic regression analysis was used. Pretest variables were included as covariates when the p-value of the relation with the dependent variable was smaller than .20. All tests were two-sided and the significance level used was p<.05.

3 Results

3.1 Tailoring Evaluation

To test whether the manipulations had differentially influenced the participants' perceptions of the extent to which the information was tailored, ANCOVAs were computed using each of the four process evaluation measures as dependent variables, condition as factor, and age, the number of cigarettes smoked a day, and self-reported arousal at the pretest as covariates. Firstly, it was tested whether the effects of condition on tailoring evaluation depended on pretest intention to quit. For none of the four measures this was the case. Secondly, the main effects of condition were tested. As shown in Table 1, the extent to which participants perceived the information as being directed to them personally approached significance, F(3,194)=2.16, p=.094.

Contrast analyses showed that participants in the FEED condition scored significantly higher (p<.05) than those in the STAN and ADAP conditions. The PERS condition did not differ significantly from any of the other conditions. The extent to which participants perceived the information as having taken into account their situation as smokers differed significantly, F(3,194)=11.42, p<.001. Contrast analyses showed that participants in the PERS condition and in the FEED condition scored significantly higher (p<.05) than those in the STAN condition. In addition, scores in the ADAP condition were significantly lower (p<.05) than the scores in the FEED condition.

Table 1

Means of tailoring-evaluation items in each condition

	Condition				Sign.
	Standard n=51	Personalized n=50	Adapted n=51	Feedback n=50	
Directed at you personally	4.10[a]	4.59	4.14[b]	4.82[ab]	.094
Takes into account your personal situation as a smoker	3.38[ac]	4.42[a]	3.44[d]	4.74[cd]	.000
Recognizes your own opinion in the information	3.60	4.13	3.95	4.12	.28
Takes into account who you are	3.13[ac]	3.80[c]	3.16[b]	3.80[ab]	.017

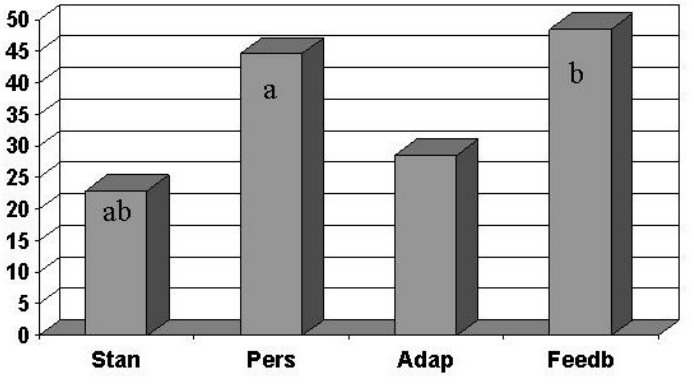
Note: Means with the same superscript differ significantly (p<.05).

With regard to the extent to which participants recognized their own opinions in the information, the conditions did not differ significantly. The extent to which participants perceived the information as having taken into account who they were, differed significantly, F(3,194)=3.48, p=.017. Contrast analyses showed that

participants in the PERS condition and in the FEED condition scored significantly higher ($p<.05$) than those in the STAN condition. In addition, scores in the ADAP condition were significantly lower ($p<.05$) than the scores in the FEED condition.

3.2 Condition Effects on Quitting Activity After Four Months

Of the 141 participants who returned the four-month follow-up questionnaire, 25.6% reported having been engaged in an attempt to quit following the lab assessment or being engaged in an attempt to quit at that time. To test the effects of condition on quitting activity, a logistic regression analysis was performed using condition as the independent variable, quitting activity (yes/no) as the dependent variable, and as covariates Gender, Age, Number of cigarettes smoked a day, and Intention to quit at pretest. To start with, several interactions of condition with pretest measures were tested. However, no significant interactions ($p>.20$) of condition, on the one hand, and gender, age, number of cigarettes smoked a day, number of years the person smoked, self-efficacy, intention and arousal experienced at pretest, on the other hand, were found. The change test indicated that the addition of the variable Condition to the covariates significantly improved the model, X^2 (3, N=141)=8.20, p=.042. Contrast analyses showed that the proportions of participants (Figure 1) in the PERS condition (44.7%) and in the FEED condition (48.5%) who made an attempt to quit, were significantly larger than the proportion in the STAN condition (22.9%). The percentage in the ADAP condition who attempted to quit (28.6%) did not differ significantly from that in the STAN condition.



Percentages of quitting attempts in the information conditions as assessed after four months. Stan=standard condition; Pers=personalization condition; Adap=adaption condition; Feedb=feedback condition. Bars with the same superscripts differ significantly ($p<.05$).

3.3 Mediation in the Prediction of Quitting Activity

In order to test to what extent the tailoring evaluations and posttest attitudes mediated the effects of condition on quitting activity, tailoring evaluations and posttest attitudes should be significantly related to condition and to quitting activity. As shown in Table 4, both measures of attitude were significantly related to condition. Furthermore, Affective attitude, but not Cognitive attitude, was significantly related to quitting activity as

indicated by the significant improvement of the model, X^2 (3, N=141)=10.62, p=.001. When condition was entered in this model including Affective attitude, the improvement test approached significance, X^2 (3, N=141)=6.34, p=.096. Thus, only slight changes in X^2 and p-value occurred, indicating a minimal mediation effect of Affective attitude. Furthermore, the two tailoring evaluation items that were significantly related to condition were entered in the logistic regression analyses to predict quitting activity. Entering the items improved the model significantly (X^2 (3, N=141)=10.92, p=.004) owing to the significant contributions of both items as indicated by the Wald tests. When condition was entered in this model, the improvement test was no longer significant, X^2 (3, N=141)=4.38, p=.22. Thus, the effect of condition on quitting activity was mediated by the scores on the tailoring evaluation items.

4 Discussion

The present study was a first attempt to develop a theory of tailoring information to individuals' characteristics, by testing potential working mechanisms separately and assessing the proposed mediating process of self-referent encoding. The main result was that personalization and feedback led to significantly more quitting activity than did the standard information only. Thus, incorporating small pieces of information on a person in a standard text - comprising no more than 800 words - increased the persuasive power of the text: it doubled the number of participants who reported quitting activity during or after four months. Furthermore, the data showed that the self-report of self-referent encoding mediated the effect of both working mechanisms on behavior. This may mean that the process of self-referent encoding is activated by the information on the person, which was incorporated in the standard text. In sum, the results of the present study provide experimental evidence that personalization and feedback can be responsible for the (sometimes) higher effectiveness of tailored intervention, at least in smoking cessation.

A question raised by the present data is why the adaptation of the information was not more effective than the standard information. The concept of adaptation of information is similar to the concept of "target group segmentation", in which general populations are segmented into relevant target groups and in which persuasive information is adapted to specified target group characteristics, such as demographic and behavioral or psychological states [16]. In target group segmentation – as in the presently used adaptation of information – persuasive information is not personalized but still written for a large audience. Two explanations can be offered for the presently found lack of effects of the adaptation condition. Firstly, the information in the adaptation condition did not contain explicit cues that indicated that the information was targeted at the individual. Therefore, the information may not have activated the process of self-referent encoding. This explanation is supported by the self-report data on self-referent encoding: the information in the adaptation condition was not perceived to better take into account "their situation as smokers" and "who they are", than the standard information. Moreover, no interactions between condition and intention to quit at the pretest were found with regard to self-referent encoding and quitting activity. Thus, the idea that the effects of the information in the adaptation condition would depend on the level of involvement did not hold. A second explanation for the lack of

effects found of the information in the adaptation condition may have to do with the operationalization of the working mechanism. The adaptation of the information was based not on empirical data but rather on a common sense approach. There are many possible ways in which information can be adapted to the individual and the results of the present study show that not all are effective. Ideally, adaptation of information is based on match-mismatch studies [8] or outcome studies, which show an interaction between an individual characteristic and certain adaptations of information.

The results of the present study must be interpreted against the background of its following features. Firstly, the participants in the study were all university students. This means that the sample was selective with regard to level of education and age. On the other hand, the sample included students with high and with low intention to quit smoking. Moreover, the students were all daily smokers. In addition, the study showed that even in students who were well acquainted with computer-technology and who may have had insight into the composition of the computer-generated texts, the manipulations were effective. Finally, the investigated psychological mechanism of self-referent encoding is considered to be a fundamental process, which does not depend on demographics. Importantly, the self-report of self-referent encoding has been found to predict quitting activity in naturalistic samples of smokers [17]. Secondly, the process of self-referent encoding was assessed using self-report. This might not be the optimal way to assess a more or less automatic information-processing process. However, the data showed the expected results: in the information conditions which contained cues about the self, more self-referent encoding was reported and exactly those condition led to more quitting activity. Nevertheless, in future studies different and more objective measures of self-referent encoding should be used, such as a recall measure [15]. Thirdly, the information in the conditions was designed to motivate smokers to engage in an attempt to quit by increasing their perceptions of the negative outcomes of smoking and the positive outcomes of quitting. The conditions did not contain information meant to sustain an attempt to quit. Moreover, the main behavioral outcome measure was engaging in an attempt to quit rather than sustained quitting.

Although the psychology of persuasive communication has made massive progress through the years, the possibilities that are offered by computer technology have barely been addressed yet. Although many of the angles to study these new possibilities will be primarily inspired by existing knowledge of (persuasive) communication, the field of tailored communications might be directed at developing explicit theories of tailored communications.

Acknowledgement. The present study was funded by a grant of the Royal Dutch Academy of Arts and Sciences.

References

1. Brug, J., Oenema, A., & Campbell, M. (2003). Past, present, and future of computer-tailored nutrition education. *American Journal of Clinical Nutrition, 77(supplement)*, 1028S-34S.
2. De Vries, H., & Brug, J. (1999). Computer-tailored interventions to promote health promoting behaviours: An introduction to a new approach. *Patient Education and Counseling*, *36*, 99-105.

3. Kreuter, M.W., Strecher, V.J., Glassman, B. (1999). One size does not fit all: The case for tailoring print materials. Annals of Behavioral Medicine, 21, 276-283.
4. Skinner, C.S., Siegfried, J., Kegler, M., & Strecher, V.J. (1993). The potential of computers in patient education. Patient Education and Counseling, 22, 27-34.
5. Skinner, C.S., Campbell, M., Curry, S., Rimer, B., Prochaska, J. (1999). How effective are tailored print communications? Annals of Behavioral Medicine, 21, 290-298.
6. Brug, J., Steenhuis, I., Van Assema, P., & De Vries, H. (1996). The impact of a computer-tailored nutrition intervention. Preventive Medicine, 25, 236-242.
7. Brug, J., Glanz, K., Van Assema, P., Kok, G., & Van Breukelen, G. (1998). The impact of computer-tailored feedback on fat, fruit and vegetable intake. Health Education & Behavior, 25, 357-371.
8. Dijkstra, A., De Vries, H., Roijackers, J., & Breukelen, van, G. (1998). Computerized tailored feedback to stimulate precontemplators to quit smoking: Three basic efficacy questions. Health Psychology, 17, 513-519.
9. Owen, N., Ewins, A.L., & Lee, C. (1989). Smoking cessation by mail: A comparison of standard and personalized correspondence course formats. Addictive Behaviors, 14, 355-363.
10. Skinner, C.S., Strecher, V.J., & Hospers, H. (1994). Physicians' recommendations for mammography: do tailored messages make a difference? American Journal Of Public Health, 84, 43-49.
11. Strecher, V.J., Kreuter, M., Den Boer, D.J., Kobrin, S., Hospers, H.J., Skinner, C.S. (1994). The effects of computer-tailored smoking cessation messages in family practice settings. Journal of Family Practice, 39, 262-270.
12. Kluger A.N., DeNisi, A. (1996). The effects of feedback interventions on performance: A historical review, a meta-analysis and a preliminary feedback intervention theory. Psychological Bulletin, 119, 254-281.
13. Oenema, A., & Brug, J. (2003). Feedback strategies to raise awareness of personal dietary intake: Results of a randomized controlled trial. Preventive Medicine, 36, 429-439.
14. Rogers, T.B., Kuiper, N.A., & Kirker, W.S. (1999). Self-reference and the encoding of personal information. In R.F. Baumeister (Ed.), The self in social psychology (pp. 372-401). Psychology Press: Philadelphia.
15. Symons, C.S., & Johnson, B.T. (1997). The self-reference effect in memory: A meta-analysis. Psychological Bulletin, 121, 371-394.
16. Ahmad, R. (2003). Benefit segmentation: a potentially useful technique of segmenting and targeting older consumers. International Journal of Market research, 45, 373-388.
17. Dijkstra, A. (1999). Are computer-tailored interventions more effective than standardized interventions? A critical test. Presentation at the 13th conference of the Europen Society of Health Psychology, Florence, Italy.
18. Dijkstra, A., & De Vries, H. (1999). The development of computer-generated tailored interventions in smoking cessation. Patient Education and Counseling, 36, 193-203.
19. Dijkstra, A., De Vries, H., Roijackers, J., & Breukelen, van, G. (1998). Computerized tailored feedback to stimulate precontemplators to quit smoking: Three basic efficacy questions. Health Psychology, 17, 513-519.
20. Owen, N., Ewins, A.L., & Lee, C. (1989). Smoking cessation by mail: A comparison of standard and personalized correspondence course formats. Addictive Behaviors, 14, 355-363.

Persuasiveness of a Mobile Lifestyle Coaching Application Using Social Facilitation

Roland Gasser[1], Dominique Brodbeck[2], Markus Degen[2], Jürg Luthiger[2], Remo Wyss[2], and Serge Reichlin[1]

[1] Medgate AG, Gellertstrasse 19, Postfach, CH-4020 Basel, Switzerland
{roland.gasser, serge.reichlin}@medgate.ch
[2] University of Applied Sciences Northwestern Switzerland, Riggenbachstrasse 16, CH-4600 Olten, Switzerland
{dominique.brodbeck, markus.degen, juerg.luthiger, remo.wyss}@fhnw.ch

Abstract. In a field study we compared usage and acceptance of a mobile lifestyle coaching application with a traditional web application. The participants (N=40) documented health behaviour (activity and healthy nutrition) daily, trying to reach a defined goal. In addition, health questionnaires and social facilitation features were provided to enhance motivation. Acceptance of the system was high in both groups. The mobile application was perceived as being more attractive and fun to use. Analysis of the usage patterns showed significant differences between the mobile and the web-based application. There was no significant difference between the two groups in terms of task compliance and health behaviour. The effectiveness of mobility and social facilitation was confounded by other variables, e.g. gender and age. Initial motivation for lifestyle change was related to the overall compliance and goal achievement of the participant. Implications show ways to strengthen the persuasiveness of health applications on mobile devices.

1 Introduction

Chronic diseases - such as obesity, cardiovascular disease, or diabetes - are among the most prevalent, costly, and preventable of all health problems today. Lifestyle behaviour plays a crucial role in the prevention and treatment of these diseases. Disease management is an approach to the treatment of chronically ill patients, consisting of a disease-specific system of decision making algorithms, coordinated healthcare interventions and communications for populations with conditions in which patient self-care efforts are significantly involved. One of the goals of these interventions is to change the health behaviour of the patients. Applying telemedical techniques to disease management has the potential to support patient's self-management and to enhance the effectiveness of the treatment of their condition.

Current telemedical disease management systems typically have limitations: They emphasise the monitoring of a patient's condition, i.e. data transfer from the patient to a centre of competence, instead of the therapeutic intervention. They make little use of the persuasive potential of computers or mobile devices.

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 27 – 38, 2006.

Interactive technologies (computing systems) have the potential to change people's attitudes and behaviours. The study of computers as persuasive technology is relatively new, but as computers progress from merely processing data, and increasingly move into our daily lives, these issues gain in relevance. Among some of the advantages that computers have over human persuaders are, that they can be more persistent, offer greater privacy, and are able to process large amounts of information [1].

Mobile devices seem particularly well suited for supporting change of behaviour, because they can intervene at the right time, in the right context and in a convenient way (always on), and facilitate social interactions. Because people always carry them around, they are more personal. This can also be a disadvantage compared to less personal desktop machines, as user acceptance is much more difficult to achieve on a very personal device like the mobile phone [1].

Mobile systems for patients are currently under development in different fields, e.g. clinical research [2,3], disease management [4], or health monitoring. Some of them are designed to enhance patient compliance in terms of drug intake or other therapy-related behaviours. Most of these studies are focusing on technical feasibility, security and usability issues. The findings are encouraging but it remains unclear if and why mobile technologies have the potential to influence patient behaviour. Especially the persuasive power of these technologies in regard to (therapy-related) lifestyle changes remains almost unexplored so far, with the exception of online self-help groups and communities [5]. The question is: How to design applications that persuade people to live healthier lives and reduce their risk for chronic diseases?

We performed a field study that compares a mobile application on a Smartphone with a functionally equivalent web application. Participants were asked to use the applications to track some aspects of their personal lifestyle, i.e. activity and healthy nutrition. A social facilitation [1] feature allowed the observation of the activities of other users. Social facilitation in persuasive technology has been used in collaboration applications [6]. In our study, we explored its persuasive power in a healthy lifestyle coaching application. We observed and measured usage patterns, compliance with the given tasks, goal achievement and subjective satisfaction indicators for both interfaces.

2 Design of the Study

The study was designed to answer the following questions:

- Can we design a functionally rich Smartphone interface that works as well as a traditional web application?
- What are the differences in usage patterns between mobile and stationary applications for the same tasks?
- Is it true that people use their mobile phones more often and more consistent with their lifestyle than desktop-based systems?
- Is there a difference between the compliance to a given daily task between users of a mobile and a web-based application?
- What is the influence of social facilitation on the effectiveness of the applications?

The task given to participants was to track their eating and physical activity habits over the course of four weeks. The goal was to eat 5 servings of fruit or vegetables per day, and to perform half an hour worth of moderate physical activity (WHO recommendations). A lifestyle that incorporates corresponding habits is generally accounted as being desirable and healthy. Therefore there were no ethical issues. Although the study only included healthy participants, it was still close to various scenarios in disease management to provide relevant insights for medical applications.

2.1 Hypotheses

We expected that a mobile lifestyle-coaching tool is increasing the desired health behaviour compared to a web-based tool. Secondly, we expected that participants with motivational support through visualization of the activities of other users (social facilitation) show higher task compliance and goal achievement than those without such support. Regarding individual differences in motivation for lifestyle changes we expected a high motivation for lifestyle-changes to be correlated to higher task compliance. And finally, we expected that those who are using the mobile application would be generally more active and show a more consistent usage pattern than those with the web-based tool.
Formally, our hypotheses were:

- There is no difference between two groups of participants – one working with a mobile application, the other with a web-based application – in terms of their lifestyle goal achievement (A).
- There is no difference in lifestyle goal achievement between a group with social facilitation and a group without (B).
- There is no correlation between motivation for lifestyle change and lifestyle goal achievement (C).
- The task compliance is the same for both groups (D).
- The usage patterns of the two systems are the same (E).

2.2 Method

Participants (N=40) were recruited for a 28-day field study through social networks, 20 were female and 20 male. Their age was between 14 and 50, the average age was 32.0, female 33.7 (SD=9.95) and male 30.4 (SD=7.56) with varied professional backgrounds and computer skills. The only requirement for the participation was the ownership of a mobile phone and the willingness use the Smartphone provided by us instead for the study.

Participants were distributed - randomly, but age and gender controlled - into two equal sized groups, resulting in 20 (10 female, 10 male) participants using the Smartphone application and the other 20 using the web interface. Participants in the first group were given the same model of a current Smartphone, which was replacing their own phone during the trial. Participants in the web group were free to choose the operating system and browser of their liking to access the web application.

The two groups then were divided into two subgroups each. Ten members were assigned to two teams of five and the other ten remained single players in each of the groups. With this set-up, we had two teams of five in the Smartphone group, and two

teams of five in the web application group. These 20 participants who were team-members were provided with a social facilitation feature in the application as explained in chapter 3. The single players were using the system without social facilitation. In summary we had four different arms in our study design, see Table 1 for the overview.

Table 1. Number of participants in the four conditions of our study design (N=40). Teams consisted of 5 players each. In brackets the average age of the participants.

	Smartphone	*Web application*
Team players	5+5 (33.7)	5+5 (30.8)
Single players	10 (30.4)	10 (33.2)

2.3 Measurements

The participants reported their goal achievements individually. Compliance with the given task was measured through logging of all activities on the study server. The daily goal was to collect seven 'lifestyle-points', with the restriction that at least 3 servings of fruit or vegetable had to be achieved. As an example, a participant could reach his daily goal by eating 4 servings of fruit or vegetables and performing 30 minutes of moderate physical activity.

Short electronic questionnaires were used to measure subjective well-being and motivation. The motivation questionnaire used the transtheoretical model ('stages of change') [7] to measure motivation for lifestyle change, i.e. the motivational attitude towards performing sports activities of at least 20 minutes 3 times a week.

At the end of the study, an online survey using the QUIS Questionnaire for User Interaction Satisfaction [8] was conducted. The questionnaire contains 27 questions about overall user reactions, screen design and navigation, terminology and system information, learning, and system capabilities on a scale from 0 to 9.

In addition, a qualitative questionnaire was used to evaluate the study in terms of attitudes and believes regarding health behaviour changes before and during the study.

3 Design of the Applications

In cooperation between the University of Applied Sciences Northwestern Switzerland and the Centre for Telemedicine Medgate, we developed a general intervention management and reporting framework that supports participants with documenting goal achievement and completing tasks such as the ones outlined above. The system supports the following factors that are generally believed to be supportive for behavioural health intervenztions [2,5]:

- Self-monitoring diary: The system allows participants to record their food and physical activity patterns in the form of a simplified points system. One serving of fruit or vegetable, or a 10-minute interval of physical activity equals one point.
- Goal setting: Reminding individuals of set goals and tracking success can build self-esteem and -confidence. The goal is to collect at least 7 points each day. If the

goal is reached then participants are rewarded with a "smiley". The more "smiley days" the better.
- Social facilitation: Social translucence [6] enables normative influence. Participants were divided into teams of 5. Individual success is made visible to the team, and the success of the whole team is visible, also in relation to the other team.
- Program compliance: The system automatically sends out reminder messages if no report was received within a specific time frame.

Using this framework, we implemented the two interfaces used in the study: A mobile application for the Smartphone, and a web application for the personal computer.

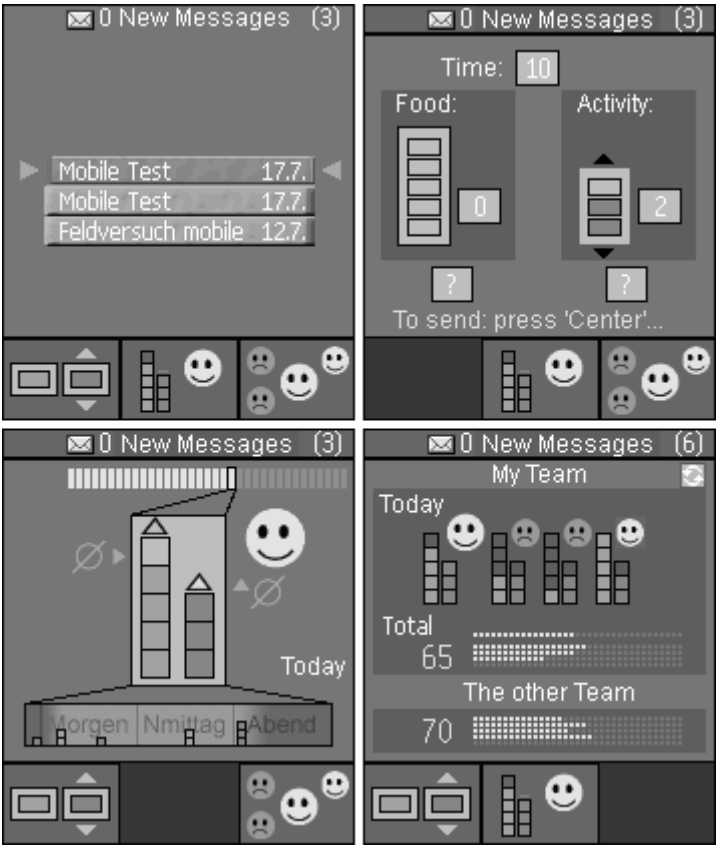


Fig. 1. The 4 main views of the Smartphone interface (from left to right, top to bottom): receive messages, report food and activity, personal goal achievement, intra- and inter-team comparison. A view is dynamically expanded when selected. When compressed, the mailbox is located at the top of the screen. The remaining (compressed) views are located along the bottom and show a condensed summary of their contents. The dark grey area is the placeholder for the expanded view. A neutral element was shown to the single players instead of the team view.

3.1 Smartphone Interface

The mobile application on the Smartphone supports the following use cases:

- Report food and activity points
- See status of daily goal achievement
- See how other team members are doing
- See how own team is doing compared to other team
- Receive messages, reminders, questionnaires
- Answer questionnaires

The interface is based on principles of information visualization (multiple coordinated views, focus & context) and direct manipulation. Screenshots are shown in Figure 1.

There are four different views that support the use cases of the application: mailbox, data entry, personal goal achievement, and team status. Each view has a fully expanded mode and a compressed mode showing a condensed summary of its contents. If a view is selected using the four-directional navigation button on the Smartphone, it is expanded and all the other views are compressed. In this way, all of the views are constantly visible, one expanded and the others compressed. There are no menus. Transitions between the views are animated to maintain temporal context.

Fig. 2. The interface for the web application user group: It provides the same functionality as the mobile interface, but on a single screen. On top the data entry fields, on the bottom left the personal view and on the right the team view (neutral element for single players).

The main challenge was to overcome the graphical limitations of the small screen, and to avoid the keyhole view effects and navigational problems of standard menu-driven interfaces that are prevalent in most Smartphone applications [9].

The single players are using a modified version without the team view. Instead of the team view, the application is showing a non-functional element without any information.

3.2 Web Interface

The interface for the web application group uses a single view design but is equivalent to the Smartphone interface in terms of functionality and information design. The messaging and reminder functionality was implemented through the use of e-mail. Figure 2 shows a screenshot of the main page.

As in the mobile application, the single players are using a modified version without the team view. Instead of the team view, the application is showing a non-functional element without any information.

Retrospective data entry in the self-monitoring diary was limited to the same day (until midnight) for the Smartphone interface, and to the previous day for the web interface. The intention was not to offend web users by forcing them to use the system after coming home late in the evening.

4 Results

Contrary to expectations, our results confirmed the hypotheses A and B. The Man-Whitney test showed no significant difference between the groups, neither between the Smartphone and web application conditions nor between the team and single player conditions. The results in terms of daily goal achievement are shown in Table 2 (the daily goal was set to at least 3 servings of fruit and a total of 7 points collected, e.g. 3 servings of fruit or vegetables and 40 minutes of bicycle riding).

Table 2. Sum of total goal achievements per group (N=40). In brackets the number of data entries per data-entry-day (days without data entry omitted) as a measurement for compliance.

	Smartphone	*Web application*
Team players	183 (4.63)	133 (3.81)
Single players	141 (4.05)	190 (4.76)

The web application users in the single player condition were as successful in terms of daily goal achievement as the Smartphone users in the team condition. A differentiation between the participants that were above and below the average of 16.2 daily goal achievements shows that there were uneven distributions within the web application condition groups (Table 3): There were 8 (out of 10) below-average participants in the web-application-team condition whereas there were 7 above-average participants in the web-application-single condition.

Table 3. Distribution of the participants according to their goal achievement results

		Smartphone	*Web application*	*Total*
Team players	Below average	5	8	13
	Above average	5	2	7
Single players	Below average	5	3	8
	Above average	5	7	12

The only significant difference that was found was between the sexes: Women have been more successful than men. There were 14 women in the above-average group, compared to only 5 men. A closer look at the reported food servings showed that the amount of food servings collected by the women was significantly higher than by the men (ANOVA: F=7.869, p=0.08). There is no difference regarding physical activity, but when we restrict the maximum to 3 points per day (i.e. cut off all excessive points) – which corresponds to the health goal of 30 minutes of moderate physical activity per day – our data show a significant difference between women and men (ANOVA: F=4.098, p=0.05) again. There seems to be a more even distribution of the physical activity performed by women compared to men in daily life. The men in our study reported more vigorous but less regular physical activity than the women.

Hypothesis C was supported by our results, but there was a strong correlation between the initial motivation to change lifestyle and the number of days with goal achievement (Spearman-Rho 0.229, p=0.155).

Contrary to expectations, both groups were equally compliant with the given tasks (hypothesis D) but the usage patterns of the applications were different from each other. As expected, hypothesis E was not supported by the results of our analysis. Figure 3 shows the daily profiles for reports received on average for each hour of the day. The Smartphone users show a smooth and continuous rise starting at 6 o'clock in the morning all the way up to 8 o'clock in the evening. We observe 4 moderate peaks that correspond to the customary eating times (9, 12, 16, 20). The variances across the day are regular, but there is an increase of the standard deviation at noon.

Reporting for the web users starts later in the morning and shows a much more irregular pattern, with reporting activity decreased around the eating times (12, 19) and a rise towards the evening hours culminating at 10 o'clock. Standard deviations are also more irregular and larger as compared to the Smartphone profile.

The comparison of the two profiles shows that the mobile phone is better integrated into daily activities. There was a much smaller delay between the actual behaviour and the documentation. On the Smartphone, more than 50% of all behaviours were reported within the same hour, whereas 30% of the behaviours reported through the web interface had a delay of 12 hours or more. These results correspond to findings from other studies in the field of electronic diaries [2, 3].

The results of our user satisfaction and acceptance survey were as follows: 30 questionnaires (QUIS questionnaire [8]) were returned, 15 for each type of interface. The average of the over-all satisfaction rating was 6.8 (scale: 0 to 9, standard deviation: 1.1) and thus clearly better than arbitrary. The main reason for dissatisfaction was a perceived lack of flexibility, caused by the fact that the application did not allow for corrections and retrospective data entry.

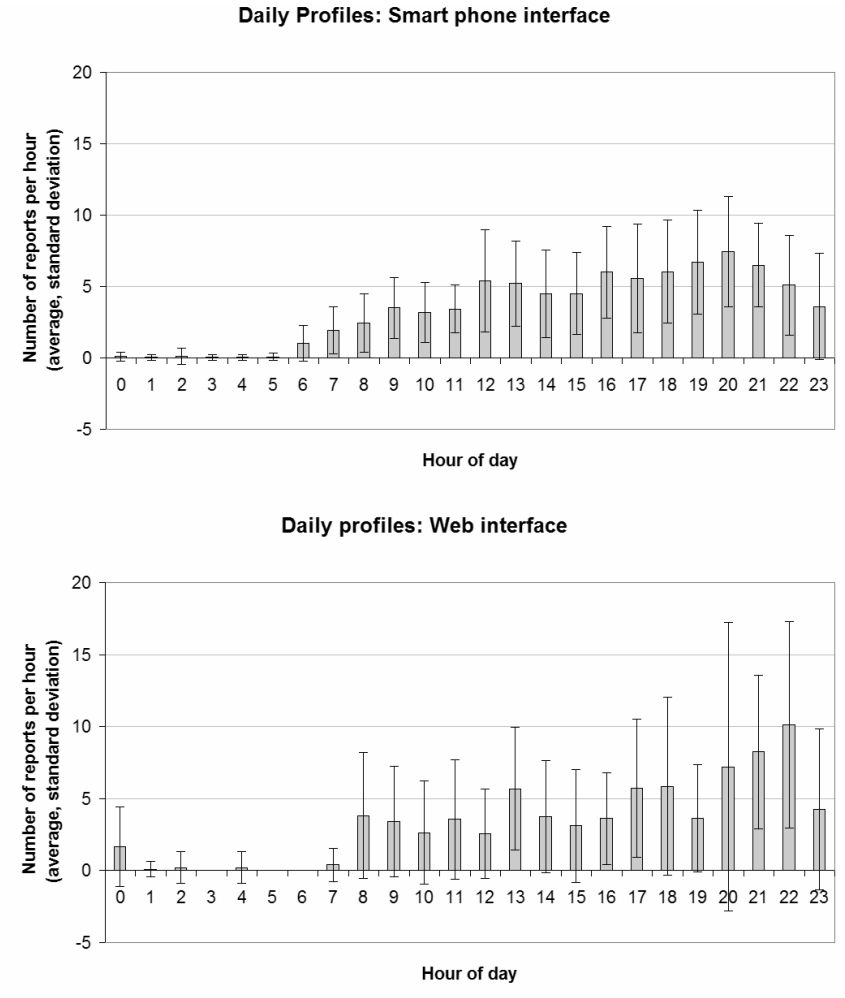


Fig. 3. Daily profiles of reporting behaviour: Usage pattern of the Smartphone interface (top) shows a more constantly distributed use, whereas the pattern of the Internet interface (bottom) shows a more scattered picture with more intense use in the evening.

Overall we found no major differences between the two interfaces in the ratings. In particular we found no significant differences in the areas of screen design, navigation, and information architecture. The web interface was rated as somewhat easier to learn and use (7.9 vs. 8.9, $p<0.003$ for t-test), but the rating for the Smartphone interface is still sufficiently high. The Smartphone interface however was rated significantly higher for the question about whether it was dull or stimulating (6.7 vs. 5.0, $p=0.01$).

Evaluation of the free-text answers about the most positive and negative aspects of the system have shown that in general, the design and the concept behind our system have been positively evaluated. Some of these positive remarks were stressing the

motivational aspects (13 participants), the simplicity (9), the usability and the design (7) and the mobility (3). Some of the critical remarks were that data entry mistakes could not be corrected in the system (10); the navigation with the Smartphone was difficult because of the navigation button (5), and problems with sending and receiving of data on the mobile phone.

The qualitative questionnaire that was distributed at the end of the study was not returned by all participants, but gave more insights concerning the health behaviours of those who did (n=14). It seems that especially for the fruit and vegetables consumption, consciousness seems to have a high influence on behaviour. Half of the respondents stated that in one way or the other. They said things like "daily documentation made me more aware of my eating habits", "the system reminded me of the goal, and this has increased my fruit and vegetable consumption", "I have been choosing more fruit and vegetables in the supermarket". 7 out of 14 have responded that they ate much more fruit and vegetables during the study than before. It seems to be more difficult to change one's habits in the area of daily physical activities. Only 5 out of 14 have responded that they were a little more active than before, but nobody has responded to have significantly changed habits in this aspect.

5 Discussion

In general one could argue that the effects we intended to measure in our study were not strong enough to be shown in such a small sample with such a great variety of participants. Age and gender, lifestyle and motivation for lifestyle changes might be too big differences within the participants and thus confound the study very strongly. For example, in our web-application-single-player group, the female participants were older than in the other groups, with an average of 37.2 years. As we know, women are more concerned about health issues in general, and possibly their concern is increasing with age. This might be a reason for this particular group to be stronger than all the others in terms of goal achievement. In a future study, we will have to carefully control confounding factors such as pre-existing health behaviour. Therefore we need to assess a baseline of the most important health behaviours and attitudes. And we need more statistical power, i.e. more participants, to measure effects that might be weaker than expected.

Some phenomena in the usage patterns call for further exploration. Why are the usage patterns so different? Is it due to the daily routines of people, e.g. Internet access in the office or restrictions in mobile phone use due to a lot of meetings or classes? – These differences in daily routines could also be a confounding factor for persuasiveness that should be considered in future work.

In addition to that we see possibilities to strengthen the persuasive effect of our system by improvement of the social facilitation feature, e.g. through the creation of aliases or avatars for the team members or functionalities like instant messaging.

6 Conclusion

We have compared a mobile behavioural health application with a web-based equivalent. The increased computational power and screen resolution of mobile devices

allows for design and implementation of increasingly complex graphical user interfaces. We have shown that it is possible to transform a medium sized interactive web application to a 176x208 pixel screen, providing the same functionality - but in a design adapted and appropriate to the device. We performed a field study with these two applications, showing that a mobile system to support behavioural health has some potential, but it is not trivial to design a study to measure these effects.

In our comparison, the mobile application was used much more frequently, more immediate and evenly throughout the day. The usage pattern is consistent for the mobile users, with slightly increased activity after lunch and in the evening. In opposition to that, the usage pattern for the web application is inconsistent, and has high variance during the day. We believe that this is due to a more restricted use of personal computers caused by external influences like daily routines, workplace and family habits. Although we have not been able to show that in our study, these restrictions might explain the higher persuasive potential of mobile compared to web-based applications. Users of both systems were generally satisfied with the ease of use and the design in general. A restriction in the study design to a certain setting, e.g. workplace with constant Internet access, could provide more insight about the persuasive power of the two approaches. The more general accessibility of the mobile device probably enhances the persuasiveness of the application.

We believe that we can design and evaluate persuasive mobile applications that are contributing to the promotion of health behaviour and compliance to disease management programs in the future. Diary-like functionalities may help to build up health consciousness, and motivation-supporting social visualizations might strengthen new behaviours that lead to a healthier lifestyle.

Future work will include the active management of transient groups of selected participants. Our framework allows caregivers to visualize, compare and filter participants' activity histories, and direct customized interventions at a group of selected participants [10]. For example, interventions could be matched to the actual motivation of a participant or take into account personal preferences, daily routines or external, location-based restrictions.

Acknowledgement

We would like to thank the Swiss Innovation Promotion Agency CTI, for providing funding for this project.

References

1. Fogg, B.J.: Persuasive Technology. Morgan Kaufmann, San Francisco (2003)
2. Palermo, T.M., Valenzuela, D., Stork, P.P.: A randomized trial of electronic versus paper pain diaries in children: impact on compliance, accuracy, and acceptability. *Pain*, Issue 107 (2004), 213-219
3. Stone, A.A., Shiffman, S., Schwartz, J.E., Broderick, J.E., Hufford, M.R.: Patient compliance with paper and electronic diaries. *Controlled Clinical Trials,* Issue 24 (2004), 182-199

4. Leimeister, M.J., Krcmar, H., Horsch, A., Kuhn, K.: Mobile IT-Systeme im Gesundheitswesen, mobile Systeme für Patienten. *HMD Praxis der Wirtschaftsinformatik*, Issue 244 (2005)
5. Eysenbach, G., Powell, J., Englesakis, M., Rizo, C., Stern, A.: Health related virtual communities and electronic support groups: systematic review of the effects of online peer-to-peer interactions. *British Medical Journal*, Volume 328 (2004)
6. Erickson, T., Kellogg, W.A.: Social translucence: an approach to designing systems that support social processes. *ACM Transactions on Computer-Human Interaction (TOCHI)*, Volume 7, Issue 1 (2000)
7. Prochaska, J.O., DiClemente, C.C.: Transtheoretical Therapy: Toward a More Integrative Model of Change. *Psychotherapy*, Issue 20 (1982), 161-173
8. Chin, J.P., Diehl, V.A. and Norman, K.L.: Development of an instrument measuring user satisfaction of the human-computer interface. *Proc. SIGCHI '88*, New York: ACM/SIGCHI, (1988), 213-218
9. Bederson, B.B., Clamage, A., Czerwinski, M.P., Robertson, G.G.: DateLens: A fisheye calendar interface for PDAs. *ACM Transactions on Computer-Human Interaction (TOCHI)*, Volume 11, Issue 1 (2004), 90-119
10. Brodbeck, D., Gasser, R., Degen, M., Reichlin, S., Luthiger, J.: Enabling Large-Scale Telemedical Disease Management through Interactive Visualization. *European Notes in Medical Informatics*, Volume 1, Issue 1 (2005) 1172-1177

Cueing Common Ecological Behaviors to Increase Environmental Attitudes

Gert Cornelissen[1], Mario Pandelaere[2], and Luk Warlop[1]

[1] Catholic University Leuven, Marketing Research Group, Naamsestraat 69, 3000 Leuven, Belgium
{Gert.Cornelissen, Luk.Warlop}@econ.kuleuven.be
[2] Catholic University Leuven, School of Research on Mass Communication, Van Evenstraat 2A, 3000 Leuven, Belgium
Mario.Pandelaere@soc.kuleuven.be

Abstract. A major obstacle for promoting sustainable (e.g. ecological) consumer behaviors is people's negative attitude towards these. We tested the potential of a persuasion technique for improving these attitudes. We propose that cueing ecological behaviors people usually engage in, increases the accessibility of previously performed ecological behavior in the memory. As several theories suggest attitudes are inferred from previous behavior, we expected the increased ease of retrieval of ecological actions to result in more favorable attitudes towards these. Two studies confirmed this hypothesis, and further research will verify the success of the technique in promoting actual environmental behavior. Implications for setting up effective social marketing campaigns are discussed.

1 Introduction

For more than 30 year, man has recognized the need for a change in consumer lifestyle towards a sustainable equilibrium between resource consumption and the natural potential to replenish these resources, as evidenced, for example, by the report to the Club of Rome, *Limits to growth* [1] Initially, scientific efforts regarding the sustainability issue have focused almost exclusively on improving the efficiency of consumption through technological innovations, for instance in production processes and waste disposal, while neglecting to search for ways to change consumption patterns and reduce the consumption levels of individual consumers [2]. This one-sided focus might yield very limited results, as achievements based on efficiency alone often result in a rebound effect, where a gain in efficiency is overcompensated by a growth in consumption volumes [3]. It is therefore important to devote scientific studies to address the issue of promoting lifestyle changes.

Although most people think positively about a green, healthy and pollution-free environment, their attitudes towards the necessary behaviors to achieve this are usually far less favorable. Unfortunately, the theory of planned behavior [4] suggests that people's attitudes towards *ecological behavior* are more important than their attitudes towards *ecology* in determining their actual behavior [5]. Clearly, improving the former attitudes would be a first step towards promoting ecological behavior.

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 39 – 44, 2006.

1.1 Attitudes

Attempting to change people's attitudes towards environmental conduct requires understanding how people construe these attitudes. There are different sources attitudes may stem from and we will use one of them as our route to persuasion. Self-perception theory [6, 7] suggests that people may derive their attitudes from their behavior. In situations where attitudes are to be constructed on the spot, or when existing attitudes are ambiguous or weak, people may derive their attitudes towards ecological behaviors from the frequency with which they engaged in them in the past [8, 9]. Now, to estimate frequencies, people often use an *availability heuristic* (e.g.,[10]). This implies that people estimate the frequency of an event by the ease with which instances of the event come to mind. Subsequently, they base themselves on this *experienced* ease of retrieval when making a judgment about themselves [11].

Menon and Raghubir [12] proposed a mere-accessibility framework to explain this effect They state that perceived ease-of-retrieval serves as both a source of information regarding the decision at hand and as a proxy for the diagnosticity of that information. This implies that increasing ease of retrieval of an judgmental input will affect both the availability and the perceived diagnosticity of this information, increasing the probability of using it in the subsequent judgment.

1.2 Overlap

The technique we propose will increase perceived ease of retrieval by increasing the pool one may draw from when retrieving instances of previous environmental behavior. To visualize this idea we introduce an overlap metaphor (see figure 1). The pool of behaviors people draw from when trying to retrieve instances of previous ecological conduct can be conceived as the intersection area between two sets of behaviors. One set contains all possible behaviors a given person usually displays, and the other set contains all possible ecological behaviors. It is important to keep in mind that assigning a certain behavior to one of these areas is done by each individual in a subjective manner. The sets are not necessarily a reflection of the objective reality.

The intersection of the two sets comprises all ecological behaviors a particular individual engages in. We hypothesize that the experienced ease of retrieving items from this overlap area influences the perceived size of this overlap area. An individual's self-perception as a green consumer is directly proportional to the perceived size of this overlap area. Subsequently, when people derive their attitudes from this information, they will be consistent with this self-perception.

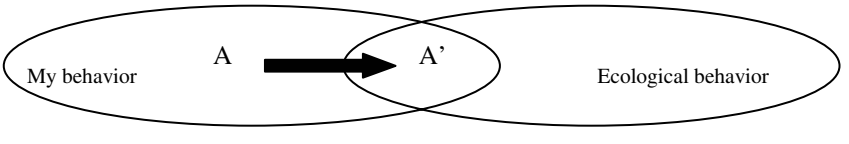


Fig. 1. The overlap methaphor. Items in the overlap area are *ecological behaviors which I perform myself* and is the pool one draws from when retrieving instances of previous environmental behaviors.

We propose that cueing ecological behaviors, which people usually perform, increases the perceived ease of retrieval of instances of previous environmental conduct. Cueing may increase the perceived ease through two routes. Obviously, cueing may have a direct influence on the ease of retrieving examples: If one is cued with 'cycling to work' one would more easily retrieve an instance of 'cycling to work' than if one is not cued.

Second, people may not label several of the ecological behaviors they engage in as such. These are instances which objectively belong in the overlap area, but are wrongly assigned to the left set (see behavior A in figure 1). If several ecological behaviors are deemed irrelevant in this way, this makes it harder to retrieve many instances of them. There are two reasons why people may disregard some ecological behaviors. People may not count the environmental behaviors which everybody engages in, like turning off lights and electrical equipment and avoid littering. Also, people may not count ecological behaviors they attribute to other reasons than their green ethics. For instance, people may not take into account 'saving energy' because they do it for economic reasons or 'sorting garbage' because it is obligatory. We assume there are several such behaviors for almost all people.

From a "logic of conversation"-perspective [14, 15], cueing these behaviors as 'ecological behaviors', may render them relevant again. In order to be accessible as evidence for past environmental conduct, the status of this kind of behaviors needs to change from merely 'something I usually do' (behavior A in figure 1) to 'something *environmental* I usually do' (behavior A' in figure 1). Relocating some of these items will increase the *perceived ease* with which ecological behaviors come to mind.

2 Studies

2.1 Study 1

In a first study we verified whether the assumed relationship between perceived overlap and attitude is valid. We measured the perceived overlap by asking our participants to list as many ecological behaviors as possible they perform themselves. Then we asked them to rate how difficult this was on a seven-point scale. Attitude towards ecological behaviors was measured with a three-item questionnaire. As an alternative and more implicit measure of attitude we asked people to associate freely with respect to the concept 'ecological behavior'.

Analog with the finding of Schwarz et al.[11], that people use ease of retrieval of instances of assertive behavior as a base to make a judgment about their own assertiveness, we hypothesized that the ease of retrieval of past ecological behaviors of the participants is related to their attitudes towards ecological behaviors.

Study 1 confirms the relationship between perceived behavioral overlap and people's attitudes towards ecological behaviors. The largest correlation we found was the one between our explicit measure of attitude and the reported difficulty of coming up with performed ecological behaviors ($r = .52$, $p < .01$, $n = 42$). This suggests that it is people's *perception* of the size of the overlap, rather than the size itself, which is related to their attitude, although the correlation between the number of generated instances and attitude was significant as well ($r = .42$; $p < .01$).

2.2 Study 2

Assuming that a more favorable attitude towards ecological behavior will result in more environmentally friendly behavior [16-18], we identified a factor in study 1, perceived overlap, which is associated with this attitude, and may therefore be exploited in a technique to promote environmental conduct. We propose that cueing with ecological behaviors that are usually performed by most people will increase this perceived overlap and, as a result, will improve participants' attitude.

2.2.1 Design and Procedure

In this experiment 160 undergraduate students took part in exchange for partial course credit. Using the responses collected in the behavior-listing task of Study 1, we constructed two different sets of behaviors: a high-overlap and a low-overlap set. The high-overlap set contained the eight most commonly mentioned *ecological behaviors which I do perform myself* from the behavior generation task in Study 1. The low-overlap set contained the most often mentioned *ecological behaviors which I do not perform*, another behavior generation task of Study 1, on which we did not report. A pretest showed that both sets of behaviors did not differ on *environmentally friendliness* (n=19, $t(18) = -.3$, $p = .77$) Participants were randomly assigned to one of three conditions: the high-overlap, the low-overlap, or the control condition.

In the high-overlap condition, participants received the high-overlap set and had to indicate, for each of the eight behaviors included, whether or not they usually display that behavior on a seven point scale (ranging from 'I totally don't agree' to 'I totally agree'). Participants in the low-overlap condition had to indicate whether or not they usually display each of the eight behaviors included in the low-overlap set. Finally, participants in the control condition had to indicate whether or not they engaged in eight behaviors that were not related to ecology (e.g., 'reading a newspaper every day', 'often eating French fries').

We tested whether our manipulation is successful in turning participant's attitudes towards ecological behaviors more favorable and whether it changes people's self-perception as ecological consumers.

2.2.2 Results

The data of study 2 support our claim that using a positive approach in green behavior promotion, emphasizing the efforts people already do is an efficient way to support the cause at hand. We demonstrated we can manipulate the perceived overlap, and render attitudes towards ecological behaviors more favorable ($F(2,157) = 7.15$, $p < .01$). The attitude of the high-overlap group ($M = .39$) was higher than the one of the control group ($M = -.30$, $F(1,157) = 13.84$, $p < .01$), whereas the attitudes in the low-overlap ($M = -.07$) condition did not significantly differ from the control group ($F(1,157) = 1.84$; $p = .23$). Not only did the attitudes improve, we also observed a change in participants' self-perception as a green consumer ($F(2,157) = 10.33$; $p < .01$). Participants in the high-overlap group perceived themselves as more responsible consumers ($M = .47$) than those in the control group ($M = -.11$; $F(1,157) = 9.95$, $p < .01$), while there was no difference between the low-overlap group ($M = -.35$) and the control ($F(1.157) = 1.48$; $p = .23$).

3 Implications

The results of two lab studies allow us to propose some guidelines for designing effective social marketing campaigns, in all areas of sustainable behavior. Traditional social marketing campaigning often implies emphasizing how poorly we are doing in a certain area. Obviously, if it wasn't for drawing attention to a flaw in our course of action, there would be no need to campaign in the first place. We propose an alternative approach, emphasizing that people have, in fact, already adopted several changes for the better. Our data suggest that drawing attention to the ecological behavior we already engage in increases the behavioral overlap and improves our attitudes towards ecological behaviors, and we hypothesize, with an analog effect on behavior.

Second, traditional campaigns usually provide an external motivation for a behavioral change, asking people to do something for the benefit of all. It is a well-documented fact that external motivation results in reduced performance and reduced persistence of a behavior, especially when that behavior is not monitored by a punishing entity [19]. Therefore it is not surprising that social marketing efforts often have only limited success in the longer run. Increasing the ease of retrieval results in a different perception of the self and therefore might lead to internal motivated behavior, which would lead to better performance and persistence of the promoted behavior. People see themselves more as someone who is willing to do an effort for the environment, or any other cause, and act upon that self-perception.

The technique we presented in this paper is related to a class of persuasion methods, which use consistency and self-perception as drivers for the effect. Compared to foot-in-the-door related strategies [20, 21], the self-prophecy phenomenon [22], the labeling technique [23-25], and induced hypocrisy [26] our overlap technique involves a less intrusive procedure. Unlike the mentioned strategies, the overlap technique does not require a first request (foot-in-the-door), an enquiry into future intentions (self-prophecy), the provocation of a certain behavior (labeling) or a communication emphasizing people's personal norms and making them conscious of past failure to comply with these norms (induced hypocrisy). It merely consists of cueing instances of past engaging in the target behavior. Therefore the technique is highly appropriate for application in mass communication campaigns.

References

1. Meadows, D. H., Meadows, D. L., Randers, J., and Behrens, W. W.: The limits to growth - A report for the Club of Rome project on the predicament of mankind. Universe Books, New York (1972).
2. Fuchs, D. A., and Lorek, S.: Sustainable Consumption governance: A history of promises and failures. Journal of Consumer Policy 28 (2005) 261-288.
3. Greening, L. A., Green, D. L., and Difiglio, C.: Energy efficiency and consumption - The rebound effect - A survey. Energy Policy 28 (2000) 389-401.
4. Ajzen, I.: The theory of planned behavior. Organizational Behavior and Human Decision Processes 50 (1991) 179-211.
5. McCarthy, J. A., and Shrum, L. J.: The recycling of solid wastes: Personal values, value orientations, and attitudes about recycling as antecedents of recycling behavior. Journal of Business Research 20 (1994) 53-62.

6. Bem, D. J.: Beliefs, attitudes, and human affairs. Brooks/Cole, Belmont, CA (1970).
7. Bem, D. J.: Self-perception theory. In: Berkowitz, L. (ed.): Advances in experimental social psychology. Academic Press, New York (1972).
8. Buss, D. M., and Craik, K. H.: The act frequency approach to personality. Psychological Review 90 (1983) 105-126.
9. Holland, R. W., Verplanken, B., and Van Knippenberg, A.: On the nature of attitude-behavior relations: the strong guide, the weak follow. European Journal of Social Psychology 32 (2002) 869 - 876.
10. Tversky, A., and Kahneman, D.: Availability: A heuristic for judging frequency and probability. Cognitive Psychology 5 (1973) 207-232.
11. Schwarz, N., Strack, F., Bless, H., Klumpp, G., Rittenauer-Schatka, H., and Simons, A.: Ease of retrieval as information: another look at the availability heuristic. Journal of Personality and Social Psychology 61 (1991) 195-202.
12. Menon, G., and Raghubir, P.: Ease-of-Retrieval as an Automatic Input in Judgments: A Mere-Accessibility Framework? Journal of Consumer Research 30 (2003) 230-243.
13. Feldman, J. M., and Lynch, J. G.: Self-Generated Validity and Other Effects of Measurement on Belief, Attitude, Intention, and Behavior. Journal of Applied Psychology 73 (1988) 421-435.
14. Grice, H. P.: Logic and conversation. In: Cole, P., and Morgan, J. L. (eds): Syntax and semantics: Speech acts. Academic Press, New York (1975).
15. Schwarz, N.: Judgment in a social context: Biases, shortcomings, and the logic of conversation. In: Zana, M. P. (ed.): Advances in experimental social psychology. Academic Press, San Diego, CA (1994).
16. Kaiser, F. G., Wölfing, S., and Fuhrer, U.: Environmental attitude and ecological behavior. Journal of Environmental Psychology 19 (1999) 1-19.
17. Minton, A. P., and Rose, R. L.: The Effects of Environmental Concern on Environmentally Friendly Consumer Behavior: An Exploratory Study - Dimensions of Environmental Concern. Journal of Business Research 40 (1997) 37-48.
18. Gill, J. D., Crosby, L. A., and Taylor, J. R.: Ecological concern, attitudes, and social norms in voting behavior. Public Opinion Quarterly 50 (1986) 537-554.
19. Deci, E. L., and Ryan, R. M.: A motivational approach to self: Integration in personality. In: Dienstbier, R. (ed.) Nebraska Symposium on Motivation. University of Nebraska Press, Lincoln (1991).
20. Cialdini, R. B.: Influence: science and practice. Allyn and Bacon, Boston (Mass.) (2001).
21. Freedman, J. L., and Fraser, S. C. "Compliance without pressure: the foot-in-the-door technique.," Journal of Personality and Social Psychology 4 (1966): 195-202.
22. Spangenberg, E. R., and Greenwald, A. G.: Social influence by requesting self-prophecy. Journal of Consumer Psychology 8 (1999) 61-89.
23. Burger, J. M., and Caldwell, D. F.: The Effects of Monetary Incentives and Labeling on the Foot-in-the-Door Effect: Evidence for a Self-Perception Process. Basic and applied social psychology 25 (2003) 235-241.
24. Kraut, R. E.: Effects of social labeling on giving to charity. Journal of experimental social psychology 9 (1973) 551-562.
25. Miller, R. L., Brickman, P., and Bolen, D.: Attribution versus persuasion as a means for modifying behavior. Journal of Personality and Social Psychology 31 (1975) 430-441.
26. Aronson, E., Fried, C., and Stone, J.: Overcoming denial and increasing the intention to use condoms through the induction of hypocrisy. American Journal of Public Health 81 (1991) 1636-1638.

Persuasive Appliances: Goal Priming and Behavioral Response to Product-Integrated Energy Feedback

Teddy McCalley, Florian Kaiser, Cees Midden, Merijn Keser, and Maarten Teunissen

Eindhoven University of Technology, Department of Human-Technology, P.O. Box 513, 5600 MB Eindhoven, The Netherlands
{L.T.McCalley, C.J.H.Midden}@tm.tue.nl

Abstract. Previous studies have shown the embedding of feedback dialogue in electronic appliances to be a promising energy conservation tool if the correct goal-feedback match is made. The present study is the first in a series planned to explore contextual effects as moderators of both the goal and the feedback. Tentative results are reported of a study where two different levels of alternative goals (related/unrelated) are primed and compared as to theory predictions of their motivational strength. Results suggest enhanced performance when an action-related goal is primed, however, more participants must be included before final conclusions can be drawn.

1 Introduction

Over the more than three decades following the 1973 energy crisis, research results have converged to support the following statements regarding household energy conservation, 1) curtailing household energy conservation has become as important as cutting industrial energy conservation because, unlike industrial use, home use is increasing 2) changes in human behavior are needed because energy efficiency through technology is not enough to meet cutback requirements, and 3) energy use feedback can work to support household conservation behavior if certain conditions are met. The present study focuses on the advancement of feedback techniques using human-machine interactive dialogue embedded in everyday household appliances.

The embedding of dialogue is done by designing a meaningful display of energy feedback for the consumer through the interface of the household appliance *and providing the means for the user to respond to the feedback before comitting to procede with the action*. It is this ability of product-integrated feedback to allow the user to immediately investigate other actions and their resulting energy consequences before making a final choice that makes it unique among electronic feedback devices. It is also this sort of simple dialogue between the user and the machine that can serve as a foundation for the development of more elaborate dialogues using, for example, smart agents that can learn about individual users and direct the energy use behavior of each person in a household accordingly.

Our own series of empirical studies have helped to refine the technique of presenting product-integrated feedback by examining moderators to feedback such as speed of

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 45 – 49, 2006.

presentation, age and gender of users, personality variables, and type of feedback such as monetary, kWh, cumulative or action specific. Prior studies have also led to the conclusion that energy use feedback is most effective if the user first sets, or is assigned, a specific (e.g. 10%) conservation goal, e.g., [1,2]. The present study explores the role of primed alternative personal goals as moderators of a specific action-related goal to save energy. According to Locke and Latham's [3] goal setting theory personal goals can mediate the effects of externally derived goals, such as assigned goals. This is because personal goals are assumed to be the most immediate and conscious motivational determinants of action [4]. However, whether the mediating effects of personal goals are positive or negative can be determined by the context.

A recent study by Shah and Kruglanski [5], predicted that the effects of an alternative goal depend on how closely it is related to the focal goal. Four experiments were carried out that varied different aspects of the accessability of alternative goals (related/ unrelated) and their motivational strength. The authors concluded that the priming of an alternative goal that was facilitatively related to the focal goal enhanced both performance and strategy development. Priming a facilitatively unrelated goal had the opposite effect. However, other research has suggested that it is not the relatedness of the alternate goal to the focal goal but the level of abstraction that is most important. Using a meta-analysis of feedback studies to support their proposed Feedback Intervention Theory, Kluger and De Nisi [6] concluded that one important function of feedback was to help direct and maintain attentional focus, and thus cognitive resources, at the focal goal level. In their view, related goals lie along a vertical continuum from task learning goals at the bottom to meta-level, or abstract goals about the self, at the top. Thus, if a focal goal was to save energy by performing a conservation action, such as turning off the lights, the activation of an alternative goal at a higher level such as "I want to be a conserver" will draw attention away from the action related goal and impede performance by, for example, making the user forget to turn off the switch.

The present study has been designed to test whether there is a difference in focal goal performance in an energy saving task between two distinct levels of abstraction of two primed goals, both related to the focal goal. According to [5], both primed goals should enhance performance but according to Kluger and De Nisi [6], only the goal related to the task performance level will improve performance. Priming the more abstract related goal should impede performance. However, such testing is not straightforward and many complexities must first be addressed, thus the reported design and data are tentative – to be confirmed and expanded at a later date. Because many individuals might already be conserving energy as much as they can, it is possible that the data from the simulated everyday task of the experiment, where only a limited amount of energy can be saved, will show a ceiling effect. Priming alternative goals at different and *specific* (personal and action-related) levels of abstration and providing an appropriate neutral and control condition is also a delicate undertaking and requires extensive piloting.

2 Method

Participants. Participants were 103 adult residents of the Eindhoven city region of the Netherlands recruited by a door to door mailing in two residential areas. These

areas were considered to be similar to most areas of the city in regards to environmental behaviors as assessed by a previous study [7].

Design. An A-B design with a control variable was used. Three levels of the treatment variable were assigned to three groups of participants. A fourth group did the experiment with no goal level being primed. The treatment variable was goal level whereby participants were primed to activate one of the three goal levels; meta level (pertains to self), action level (pertains to a specific action) , and neutral. Environmental attitude was identified as a control variable and was determined using the General Environmental Behavior scale by Kaiser [7]. The dependent variable was the percent change score in energy consumption before versus after goal priming.

Measurements. Before proceeding, a manipulation check of the three priming conditions was carried out. Three scenarios, each consisting of a series of slides made up the three priming conditions; one designed to prime a meta-level goal concerning the participants' personal desire to preserve the environment, another, an action level goal concerning specific actions to save energy and thus the environment and the third was to be neutral, and thus should not activate an environmental goal. Thirty participants were asked to view all the scenario'sthen asked to answer which statement best represents their thoughts regarding the slide show; "Concern for the environment", "Saving energy", "Appreciate your environment" or "Nothing". The first answer represents a meta-level goal, the second an action level goal and the last two represent a neutral goal. Each scenario was found to prime the intended goal level with little or no loverlap. Participants rated the metalevel scenario as presenting "Concern for the environment" ($\chi^2 = 30.20$, $p < 0.00$), the action level scenario was rated as "Saving energy" ($\chi^2 = 42.40$, $p < 0.00$). Finally the neutral scenario was rated almost equally as either representing "Appreciate your environment" or as presenting "nothing". These results indicate that the scenarios primed distinct answers representing the goal level that was intended.

Procedure. Participants were randomly assigned to each of the four conditions and asked to "do these washes as you would at home" by completing several simulated washing trials on a computer. The simulated washing machine panel was a copy of a current state-of-the-art model with the addition of an energy meter that provided participant's with kWh feedback for each of their chosen wash programs. The program explained each step of the experiment, and was operated by the mouse. Participants were first required to complete 10 washing trials, the last six of which were used to determine each individual's baseline energy consumption. Participants in any of the three implicit goal activation conditions were then shown the corresponding slide show and told that this was to pass the time while the computer was saving. One slide show was about the environment in general, stating that it can be improved by being a conservationist, another gave practical tips to save energy along with slides of light switches being turned off etc., and lastly a neutral show that was designed not to prime environmental goals, displayed photos of the university and its surroundings. Finally, the control group received just a blank screen telling them to wait while the computer was calculating. Next, all participants were asked to set an energy conservation goal (explicit goal) of 0, 5, 10, 15 or 20 percent. Twenty more washing trials followed and were used to determine savings by comparing mean

kWh per wash to that of the baseline trials. Following the task trials, the GEB [7] questionnaire was administered. The final part of the experiment consisted of some general background questions.

3 Results and Discussion

The average percent change score was calculated using the mean kWh per wash of the six baseline setting trials and the final twenty washing trials. Energy saving scores were 13.61% for the meta-level treatment, 18.58% for the action level, 17.25% for the neutral level, and 10.43% for the control condition. The score of the so-called neutral condition indicated that neutrality was violated, and as there was a pure control group, it was decided to drop the neutral group data from analysis. ANOVA was used to test for significant differences between the three remaining groups. As income level had been found to be a significant predictor of the GEB behavioral score ($F(4, 102) = 2.44$, $p=.05$), indicating that it would have an effect on energy saving it was included as a fixed factor. The main effect for the percent of savings was found to be significant ($F(2, 77) = 4.04$,$p=.02$). A simple contrast was performed resulting in no significant difference between the primed meta-level alternative goal and the control condition and a significant difference ($p=.01$) between the action level goal condition and the control. The outcome in terms of theoretical interpretation is, however, not clear cut. One would expect from FIT [6] that priming an alternative action related goal might increase performance because it helps to maintain attention at the action level but the significant savings in the action goal condition could also be interpreted as support for Shah and Kruglanski [5] because a closely related goal appears to enhance performance. However, if they are correct, then both primed goals should enhance performance. A closer look at the data reveals that the contrast between the meta-level and the control nearly reached significance ($p=.06$). This tips the scales somewhat away from an FIT interpretation, however, it is not appropriate to speculate further on the tentative results but rather to concentrate on how the design and analysis might be further improved.

In considering the sample, a convenience sample of two neighborhoods in close proximity to the university was used. Answers to the short questionnaire at the end of the experiment suggest that the participants were mostly retired people with rather higher incomes and larger homes than the average city resident. The high income group was particularly concentrated in the action level priming group. McCalley & Midden [2] found that persons with higher incomes were less likely to be concerned with energy conservation than other groups. Data collection will therefore continue with a focus upon attaining a better balanced sample. Furthermore, there was a significant negative correlation ($p=.003$) between participants' scores on the GEB and how much energy they used per wash in the six baseline setting trials. This outcome indicates that people who scored high as conservers on the GEB were already saving energy before the experimental treatment and therefore were subject to a ceiling effect whereby they could not save more energy despite a high motivation. This will be taken into account after more data is collected and time allows a more in-depth analysis.

Although the results are not as robust as desired, the percent savings are as great or greater than other recent comparable feedback intervention experiments, e.g., [8], where savings rarely reached over ten percent. This replicates earlier successful results of the product-integrated goal plus feedback design [2].

References

1. Becker, L. J., (1978). Joint effect of feedback and goal setting on performance: A field study of residential energy conservation. *Journal of Applied Psychology*, *63*, 4, 428-433.
2. McCalley, L. T., & Midden, C. J. H., (2002). Energy conservation through product-integrated feedback: The roles of goal-setting and social orientation. Journal of Economic Psychology, 23, 5, 589-603.
3. Locke, E. A., & Latham, G. P., (2002). Building a practicaly useful theory of goal setting and task motivation. American Psychologist, 57, 9, 705-717.
4. Austin, J. T., & Vancouver, J. B. (1996). Goal constructs in psychology: Structure, process, and content. Psychological Bulletin, 120, 3, 338-375.
5. Shah, J. Y., and Kruglanski, A. W. (2002). Priming against your will: How accessible alternatives effect goal pursuit. Journal of Experimental Social Psychology, 38, 368-383.
6. Kluger, A. N. & DeNisi, A. (1996). The effects of feedback interventions on performance: A historical review, a meta-analysis and a preliminary feedback intervention theory. Psychological Bulletin, 119, 2, 254-284.
7. Kaiser F.G., Midden C. J. H. & Geven A. (2004). Milieugedrag in Eindhoven. Gemeente Eindhoven afdeling bestuursinformatie en onderzoek.
8. Wood, G. & Newborough, M. (2003), Dynamic energy-consumption indicators for domestic appliances. Energy and Buildings, 35, 821-841.

The Persuasive Power of Mediated Risk Experiences

Anneloes Meijnders, Cees Midden, and Teddy McCalley

Eindhoven University of Technology, Department of Human-Technology Interaction,
P.O. Box 513, 5600 MB Eindhoven, The Netherlands
{A.L.Meijnders, C.J.H.Midden, L.T.McCalley}@tm.tue.nl

Abstract. This paper discusses the use of multimedia techniques and augmented reality tools to bring across the risks of global climate change. We look back on a series of experiments showing that vividness is a key factor in creating emotional risk responses and fostering attitude change through systematic information processing. However, the effects were modest even when vivid and concrete images and texts were used in combination with ominous sounds and music. The next step therefore is to explore and make use of the possibilities of multimedia techniques and augmented reality to provide people with a simulated risk experience. This paper concludes with a preview of this work, the focus of which is on the sense of presence.

1 Introduction

People may have trouble comprehending the consequences of climate change and anticipating how much they will like, or dislike, them [1]. One of the reasons why this may be difficult is that people experience weather, not climate. Although people tend to draw inferences about climate change from their weather experiences [2], [3], [4], [5], local weather fluctuates much more than global climate [6]. Also, local weather and nature observations do not even reveal a fraction of the complexity of the Earth's climate and ecosystems. Another reason why we cannot take for granted people's understanding of the consequences of climate change, is that we do not know how well people are able to imagine dramatic changes and what it will be like to live with these changes [1].

The importance of personal risk experiences in determining risk expectations and responsiveness to warnings becomes apparent, for instance, in a study by O'Connor et al. [7] on the use of weather and climate forecasts by water managers. Managers who expected to be confronted by weather and climate problems in the next decade were more likely to use forecasts in planning, budgeting, and starting public conservation campaigns than managers who did not expect future problems. These expectations were found to be closely linked with past experiences. Managers, who experienced problems due to events such as flood emergency and sustained above-average precipitation in the past, were more likely to expect problems in the future than managers who did not. Particularly emotional injury has been found to influence preparedness for future natural disasters. In a study by Siegel et al. [8], subjects who had experienced emotional injury due to a severe California earthquake were shown to be significantly

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 50 – 54, 2006.

better prepared for the threats of "El Niño" four years later. Interestingly, physical injury and financial loss due to the first disaster had no preparedness effect.

If past risk experiences increase people's responsiveness to information and preparedness to undertake action we may wonder whether similar effects can be generated by providing people with mediated or virtual risk experiences. The main goal of this article is to investigate the emotional impact of such imitated risk experiences as a function of two characteristics: vividness and presence. The ultimate aim is to increase risk communication effectiveness in stimulating protective action.

2 Vividness

Following Nisbett and Ross [9] we define a vivid risk presentation as emotionally interesting, concrete and imagery provoking, as well as proximate in a sensory, temporal, or spatial way. Researchers have employed various methods to increase information vividness, such as using concrete and specific language, pictures and videotaped presentations, first-hand information, and case-history information [10]. Past research using text and pictures has shown that a more vivid presentation of health risks resulted in stronger emotional responses, higher assessments of severity and vulnerability, and higher levels of coping [11]. However, in this study variations in vividness were confounded with variations in content and therefore it is not possible to separate the effects of affective and cognitive aspects of the risk presentation.

The aim of our own research was to independently study the effects of the vividness of risk presentations without co varying the contents of these presentations [12, [13], [14]. For this purpose we developed two videos about climate change, which provided basically the same information about climate change, but with a different degree of vividness. Both videos explained in about 3.5 minutes the causes and consequences of global warming and concluded with a general recommendation to search out the energy expenditure of domestic appliances and to consider ways to reduce energy consumption in the home.

We thus took care to keep the information in both videos basically identical. We varied however the music, the voice-over and the images to create a difference in vividness. The only music in the pallid video was an opening and end tune, the voice-over was factual and low in expressiveness, and neutral images were used to visualize climate change and its possible consequences. To give an example, schematic computer animations were often applied in this video. In contrast, in the vivid video dramatic images, for example of human beings in distress, were used to visualize what might happen as a consequence of climate change. Also, ominous sounds and music were applied to underline the dramatic content of the images and the voice-over was highly expressive.

In a series of experiments using both student and non-student samples we examined the effects of the two videos on emotions, risk perception, knowledge about climate change, and responsiveness to subsequent information about energy saving in a between-subjects set-up (for a detailed description of these studies, see [12]). The hypothesis was that the vivid video would induce stronger emotional responses than the pallid video, while not leading to higher perceived risk or more knowledge about

climate change. Secondly, we hypothesized that the vivid video would stimulate responsiveness to information more than the pallid video.

The videos were shown to the individual participants on a 15-inch TV screen. The sound was played through a headphone. After watching either the pallid or the vivid video participants were asked questions about their feelings, risk perceptions, and knowledge about climate change. Responsiveness to subsequent information was measured by providing participants with information on energy saving devices and examining how thoroughly they processed this information, as indicated by measures of cognitive responses, recall, and attitudes towards using the energy saving devices.

The results showed that the vivid video elicited stronger emotional risk responses than the pallid video. Importantly, the videos did not differentially influence risk perception and knowledge. We thus succeeded in influencing emotional risk responses independent of cognitive risk responses by varying the vividness of the risk presentation.

Some indications were found that the vivid video about climate change increased responsiveness to subsequent information about energy saving devices more than did the pallid video. However, the effects were weak. This may have had to do with emotion levels that were moderate at best, even following the vivid risk presentation. In the next paragraph we turn to the role of presence in increasing the motivational power of simulated risk experiences.

3 Presence

Because the videos used in our previous research to portray the risks of climate change had the structure of an information message and were shown on a rather small television screen, it is not likely that people really felt present in the depicted scenes. Although the vivid video succeeded in giving people a lively impression of floods and other consequences of global climate change, this is something entirely different than giving people the sensation that they *are* in a flooded area.

The feeling of being in the mediated environment or situation is referred to as presence. It can be viewed as the experiential counterpart of immersion [15]: the physical properties of the media technology that facilitate absorption into the mediated environment or situation. Screen size, image motion, and stereoscopic presentation are examples of properties that have been found to be related to people's sense of presence [16]. Research has shown that the immersiveness of a simulated environment is critical in obtaining similar effects as in real environments, such as for instance desensitization effects in phobia treatment (e.g., [17], [18], [19] and restoration effects in stress treatment [20].

To our knowledge, the use of immersive technology to simulate environmental risk experiences for persuasive purposes is rather new, and the relations between immersiveness, emotional reactions, and persuasive impact have not been studied before. Using immersive technology has a number of advantages [21]. A simulation can be used to obtain the motivating effect of a real risk experience but without the real dangers. People could for instance be motivated to undertake protective actions against flooding by exposing them to a simulation demonstrating the power of water. If this safe confrontation with the destructive consequences of flooding would convince

them to take measures such as for instance installing protective barriers for windows and doors, property damage and perhaps even physical injury could be greatly limited in case of a real confrontation. It should be noted that paradoxically, the more successful we are in constructing a safe imitation of reality, the more we should be aware of potential ethical issues. Exposing people to a realistic approximation of a flooding experience may require extraordinary measures to assure ethical acceptability.

A second advantage concerns the understanding of cause-and-effect relations [21]. Since the pre-industrial era the Earth's climate has changed on both global and regional scales [22]. These changes are partly attributable to increased emissions of CO_2 and other greenhouse gases caused by human activities. Public understanding of the human contribution to climate change is hampered by spatial and temporal separation of causes and effects. The use of a simulation may help to overcome these barriers to understanding, because it enables immediate observation of relations between causes and effects that in reality are spatially or temporally separated. Related to this, a simulation also allows people to try out alternative causes of action and observe their effects [21].

Damages caused by climate change can be reduced by a twofold strategy of on the one hand mitigation and on the other adaptation [22]. Our research agenda for the next couple of years focuses on the relation between flooding experiences and the motivation to take adaptive measures. After studying the quality of real flooding experiences and the effects of these real experiences on people's sensitivity to warnings and information about protective measures, we will proceed with exploring the factors determining a successful application of technology to provide people with a mediated flooding experience. In particular, we will test the hypothesis that increasing the sense of presence can increase the effectiveness of mediated risk experiences by enhancing their emotional impact. The ultimate goal of this research is to develop more persuasive forms of risk communication, based on a better understanding of the power of experience, by making use of immersive audio-visual media

References

1. Fischhoff, B., Furby, L.: Introduction to: Psychological Dimensions of Climate Change. In: Chen, R.S., Boulding, E., Schneider, S.H. (eds.): Social Science Research and Climate Change: An Interdisciplinary Appraisal. D. Reidel Publishing Co., Dordrecht, The Netherlands (1983) 177-203
2. Bostrom, A., Morgan, M.G., Fischhoff, B., Read, D.: What do people know about global climate change? 1 Mental models. In Risk Analysis 14 (1994), 959-970
3. Kempton, W.: Lay perceptives on global climate change. Global Environmental Change, June (1991) 183-208
4. Read, D., Bostrom, A., Morgan, M. G., Fischhoff, B., Smuts, T.: What do people know about global climate change? 2. Survey studies of educated laypeople. In Risk Analysis 14 (1994), 971-982
5. Weber, E.U.: Perception and expectation of climate change. Precondition for economic and technological adaptation. In M.H. Bazerman, D.M. Messick, A.E. Tenbrunsel, K.A. Wade-Benzoni (eds.): Environment, ethics, and behavior. The psychology of environmental valuation and degradation. The New Lexington Press, San Francisco, CA (1997), 314-341

6. KNMI: De toestand van het klimaat in Nederland 2003 [Climate Conditions in the Netherlands, 2003]. KNMI, De Bilt, The Netherlands (2003)
7. O'Connor, R.E., Yarnal, B., Dow, K., Jocoy, C.L., Carbone, G.J.: Feeling at risk matters: Water managers and the decision to use forecasts. In Risk Analysis 25 (2005), 1265-1275
8. Siegel, J.M., Shoaf, K.I., Afifi, A.A., Bourque, L.B.: Surviving two disasters. Does reaction to the first predict response to the second? In Environment and Behavior 35 (2003), 637-654
9. Nisbett, R.E., Ross, L.: Human inference: Strategies and shortcomings of social judgment. Prentice Hall, Englewood Cliffs, NJ (1980)
10. Taylor, S.E., Thompson, S.C.: Stalking the elusive 'vividness' effect. In Psychological Review 89 (1982), 155-181
11. Rippetoe, P.A., Rogers, R.W.. Effects of components of protection-motivation theory on adaptive and maladaptive coping with a health threat. Journal of Personality and Social Psychology 52 (1987), 596-604
12. Meijnders, A.L.: Climate change and changing attitudes. Effect of negative emotion on information processing. Dissertation, Eindhoven University of Technology, The Netherlands (1998)
13. Meijnders, A.L., Midden, C.J.H., Wilke, H.A.M.: Communications About EnvironmentalRisks and Risk Reducing Behavior: The impact of Fear on Information Processing. In Journal of Applied Social Psychology 31 (2001), 754-777
14. Meijnders, A.L., Midden, C.J.H., Wilke, H.A.M.: Role of negative emotion in communication about CO2 risks. In Risk Analysis 21 (2001), 955-966
15. IJsselsteijn, W.A.: Presence in depth. Dissertation, Eindhoven University of Technology, The Netherlands (2004)
16. IJsselsteijn, W. A., de Ridder, H., Freeman, J., Avons, S. E., Bouwhuis, D.: Effects of stereoscopic presentation, image motion and screen size on subjective and objective corroborative measures of presence. In Presence: Teleoperators and Virtual Environments 10 (2001), 298-311
17. Hoffman, H. G., Garcia-Palacios, A., Carlin, A., Furness, T. A. III, Botella-Arbona, C.: Interfaces that heal: Coupling real and virtual objects to treat spider phobia. In International Journal of Human-Computer Interaction 16 (2003) 283-300
18. Regenbrecht, H. T., Schubert, T. W., Friedmann, F.: Measuring the sense of presence and its relations to fear of heights in virtual environments. In International Journal of Human-Computer Interaction 10 (1998), 233-249
19. Wiederhold, B. K., Davis, R., Wiederhold, M. D.: The effects of immersiveness on physiology. In: G. Riva, B. K. Wiederhold, E. Molinari (eds.) Virtual Environments in Clinical Psychology and Neuroscience. IOS Press, Amsterdam (1998)
20. Kort, Y.A.W. de, Meijnders, A.L., Sponselee, A.-M.: What's wrong with virtual trees? Restoring from stress in a mediated environment (submitted for publication)
21. Fogg, B.J.: Persuasive technology. Using computers to change what we think and do. Morgan Kaufmann, Amsterdam, The Netherlands (2003)
22. Watson, R.T., Albritton, D.L., Dokken, D.J.: Climate change 2001: Synthesis report. Intergovernmental Panel on Climate Change c/o World Meteorological Organization, Geneva (2001)

Social Presence as a Conduit to the Social Dimensions of Online Trust

Peter de Vries

Twente University,
Marketing Communication and Consumer Psychology,
7500 AE Enschede, The Netherlands
p.w.devries@utwente.nl

Abstract. Trust is considered to reduce uncertainty, and, therefore, is a prerequisite for people to engage in online transactions. Social presence potentially bridges the discrepancy between offline and online commerce in terms of face-to-face interaction. These concepts are often studied under the assumption that social presence in itself increases trust. In addition, these studies typically treat trust as a unidimensional concept. The proposed research targets the influence of social presence on trust by taking account of the multidimensional nature of the latter, as well as the attributions made to the salient person. It is expected that behavioural information, i.e., the expressed preference of a referent in a product choice task, will only affect social trust dimensions if the salience of this referent is increased by means of displaying an image. Data will be available at the time of the conference.

1 Introduction

With ever so many companies venturing online, many aspects of the consumption process no longer require people to leave the confines of their homes. Many consumers are, nevertheless, hesitant to engage in online transactions. Of the various obstacles mentioned, the most prominent are privacy and security issues (28 – 31 %), lack of customer service (22 - 28 %), including the inability to reach someone in case of problems while shopping and after sales, and lack of interaction (9 – 15 %) with salespersons or friends [1]. These findings indicate that online purchasing differs from its offline counterpart in two important respects, i.e., higher levels of experienced uncertainty, requiring greater trust in order to reduce this, and a lack of face-to-face interaction.

1.1 Trust

Trust is generally considered to reduce uncertainty [2], and is, therefore, a crucial factor for people to engage in online transactions. It is often regarded to have multiple dimensions, some of which involve emotions and attributions to agents, whereas others are more calculative in nature. Lewis and Weigert [3], for example, distinguished between cognitive and emotion-based trust (cf. [4], [5]), with assessments of competence feeding the former, and integrity, goodwill, and value congruence the latter.

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 55 – 59, 2006.

Similarly, Mayer, Davis, and Schoorman [6] distinguished between ability, integrity and benevolence (cf. [7], for an overview, see [8], [6]). Consumer trust in, for instance, a salesperson can be based on calculative assessments of competence or ability, as well as attributions as benevolence and integrity. Online relationships, on the other hand, involve trust which is less likely to be based on such attributions (cf. [9], [10]), as specific interaction partners are not present – at least not physically. Consequently, trust in online contexts could be argued to be more superficial and, perhaps, unstable compared to interpersonal trust.

An important question, therefore, would be whether physical presence of transaction partners can be substituted for a virtual presence; perhaps the increased salience of a physically absent other in online interactions will appeal to the social dimensions of trust, which would otherwise lie dormant.

1.2 Social Presence

Short et al. defined social presence as the "degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships" ([11], p. 65; for an overview of various definitions, see [12]). As such, the concept of social presence can be applied to situations in which some else is physically present, but also to interactions in which the presence of an other is merely implied or imagined (cf. [13]), as would be the case when a consumer visits an e-commerce web site with images of persons or biographical notes.

Corritore, Wiedenbeck, and Kracher [14], however, noted that studies regarding the effectiveness of images of company personnel in commercial websites have yielded contradictory results. Whereas Walker, Sproull, and Subramani [15], for instance, found positive differences between talking-face and text displays in terms of time-spending and the occurrence of mistakes in tasks, Riegelsberger [16], on the other hand, reported only to have found positive effects on self-reported trust after a superficial exploration of an e-commerce vendor's website; once users proceeded beyond the initial exploration, this effect disappeared.

In laboratory studies involving social influence in computer-mediated communication, many have reported simple cues to (social) identity to be rather successful (e.g., see [17]). Studies in the context of the social influence model of deindividuation (SIDE; e.g., see [18], [19]), for instance, show that images of people are successful cues to identity that are, in fact, accentuated by the sparseness of information in online environments. In case of anonymity, for instance when images of persons are not available, people will become more sensitive to social category membership cues such as gender [20], [21], [22].

In sum, images and biographical information may increase the salience of other people. Cues to social category membership, on the other hand, increase the salience of social groups. It is not clear, however, what the effects of group salience on social presence are. Instead of making a specific individual salient, it could be argued to increase salience of a non-specific group member, or exemplar, which possesses the characteristics typically associated with this particular group. This would imply that providing social group cues could also lead to an increase in experienced social presence.

1.3 How Social Presence Could Influence Trust

As noted above, most trust researchers prefer a distinction between such dimensions as ability or competence on the one hand, and integrity and benevolence on the other. The latter category involves human dispositions, and, as such, requires the salience of a person. The former, on the other hand, does not require agency per se. If indeed trust is influenced by the experience of social presence, or, in Short et al.'s definition, the salience of another person, it is likely that this influence manifests itself especially in the latter category. In this view, social presence would act as a conduit, by bringing trust's social dimensions into play in online contexts.

Although many researchers have tried to build consumer trust by displaying personal information, such as photographs of people, in attempts to increase the experience of social presence (e.g., see [23], [8], [24]), very few have done so while taking account of the multidimensional nature of trust but see [8]. In addition, studies on social presence and trust as a unidimensional concept are often based on the assumption that the experience of social presence is beneficial for trust to emerge (e.g. [8], [25], cf. [26], in the context of media richness). The valence of a trust judgement, however, is not likely to depend on the mere presence or absence of an image, but also on the attributions made to the salient person (e.g., see [27]); the experience of social presence can only be expected to aid trust formation when the portrayed person is actually perceived as trustworthy.

In the context of online advice, information providers are likely to be judged on their "behaviour", e.g., the quality of their advice, or whether advice is biased. Behaviour is likely to increase trust, for instance, if it allows interpretation in terms of benevolence or integrity towards the consumer, but not if ulterior motives such as greed are suspected. Behavioural information can be available to consumers regardless of whether a specific source is salient; online medical advice, for instance, may be obtained from a specified physician, but also from non-specific sources. It could be argued, however, that its impact on trust does depend on the salience of a specific individual, as the social dimensions of trust require agency.

An experiment will be conducted to examine these ideas in the context of online product advice. Several products and services are presented pairwise, and each time participants are informed about the preference of a referent for either of the two options (i.e., the referent's behaviour). This referent is either made salient by means of an image and minimal biographical information, or not; the referent's expressed preference is either in favour of the most expensive of the two options (implying greed), or not (implying benevolence). Based on the above, the following hypotheses were formulated:

H1: Individuating cues, i.e., images and biographical information, will increase the salience of the referent, i.e., the experience of social presence;
H2: The effect of the referent's preference (as either biased or not) on the social dimensions of trust is moderated by the experience of social presence. Specifically, only if individuating cues are supplied will scores on these dimensions be affected by whether the referent's preference is biased or not.

As noted earlier, it is not clear whether social group membership cues will also influence the experience of social presence. Therefore, no corresponding hypotheses are formulated.

2 Experiment

At least 160 freshmen students of the faculty of Behavioural Sciences at the University of Twente, The Netherlands, are scheduled to take part in this study, which has a 2 (Behaviour: Consistent high-price preference versus mixed-price preference) * (Individuating Cue: yes versus no) * 2 (Social Cue: yes versus no) between-participants design.

Participants are requested to judge a series of products displayed pair-wise. Each time, they are asked to choose the one they think is best. Each product is accompanied by a list of features (including price), and for each pair of products a suggestion is made by an online referent. This referent displays either a strong preference for the most expensive of each pair of products or a balanced preference, recommending low and high price products to an equal extent. The former is expected to cause participants to realise that this referent's advice is motivated by greed, whereas the other could be viewed as more benevolent towards participants' interests. In one Individuationg Cue condition the referent is represented by an image, whereas in the other condition a grey square of the same size as the picture is displayed. Finally, this referent either belongs to an ingroup (students at Twente University) or not.

The effects of these manipulations will be measured on a number of dependent variables, such as trust (overall, as well as per dimension), social presence, and the decision to follow the referent's suggestions.

Data, conclusions, and discussion will be available at the time of the conference.

References

1. Ahuja, M., Gupta, B., & Raman, P.: An empirical investigation of online consumer purchasing behaviour. Communications of the ACM, 46 (2003) 145-151.
2. Luhmann, N.: Trust and Power. New York: Wiley (1980).
3. Lewis, D. & Weigert, A.: Trust as a social reality. Social Forces, 63 (1985) 967-985.
4. McAllister, D. J.: Affect- and cognition-based trust as foundations for interpersonal cooperation in organizations. Academy of Management Journal, 38 (1995) 24-59.
5. Johnson, D. & Grayson, K.: Cognitive and affective trust in service relationships. Journal of Business Research, 58 (2005) 500-507.
6. Mayer, R. C., Davis, J. H., & Schoorman, F. D.: An integrative model of organizational trust. Academy of Management Review, 20 (1995) 709-734.
7. Yamagishi, T. & Yamagishi, M.: Trust and commitment in the United States and Japan. Motivation and Emotion, 18 (1994) 130-166.
8. Gefen, D. & Straub, D. W.: Consumer trust in B2C e-commerce and the importance of social presence: experiments in e-products and e-services. Omega, 32 (2004) 407-424.
9. Siegrist, M., Cvetkovich, G. T., & Gutscher, H.: Shared values, social trust, and the perception of geographic cancer clusters. Risk Analysis, 21 (2001) 1047-1053.

10. Earle, T. C., Siegrist, M., & Gutscher, H.: Trust and confidence: A dual-mode model of cooperation. Unpublished Manuscript, Western Washington University, WA, USA. (2002).
11. Short, J., Williams, E., and Christie, B.: The social psychology of telecommunications. London: Wiley (1976).
12. Biocca, F., Harms, C., & Burgoon, J. K.: Toward a more robust theory and measure of social presence: Review and suggested criteria. Presence, 12 (2003) 456-480.
13. Latané, B.: The psychology of social impact. American Psychologist, 36 (1981) 343-356.
14. Corritore, C. L., Kracher, B., & Wiedenbeck, S.: Online trust: concepts, evolving themes, a model. International Journal of Human-Computer Studies, 58 (2003) 737-758.
15. Walker, J., Sproull, L., and Subramani, R. Using a human face in an interface. In (85-99). Boston: ACM Press (1994)
16. Riegelsberger, J.: Trust in Mediated Interactions. Doctoral thesis, University of London, United Kingdom, (2005)
17. Nass, C. & Moon, Y.: Machines and mindlessness: Social responses to computers. Journal of Social Issues, 56 (2000) 81-103.
18. Spears, R. & Lea, M.: Panacea or panopticon? The hidden power in computer-mediated communication. Communication Research, 21 (1994) 427-459.
19. Postmes, T., Spears, R., & Lea, M.: Breaching or building social boundaries? SIDE-effects of computer-mediated communication. Communication Research, 25 (1998) 689-715.
20. Nass, C., Moon, Y., & Green, N.: Are computers gender-neutral? Gender stereotypic responses to computers. Journal of Applied Social Psychology, 27 (1997) 864-876.
21. Lee, E.-J.: Effects of "gender" of the computer on informational social influence: the moderating role of task type. International Journal of Human-Computer Studies, 58 (2003) 347-362.
22. Lee, E.-J.: Effects of visual representation on social influence in computer-mediated communication: Experimental tests of the social-identity model of deindividuation effects. Human Communication Research, 30 (2004) 234-259.
23. Riegelsberger, J., Sasse, M. A., & McCarthy, J. D.: Shiny happy people building trust? Photos on e-commerce websites and consumer trust. Proceedings of CHI2003, 5-10 April, Ft.Lauderdale, Florida (2003) 121-128.
24. Tanis, M. & Postmes, T.: A social identity approach to trust: Interpersonal perception, group membership and trusting behaviour. European Journal of Social Psychology, 35 (2005) 413-424.
25. Rocco, E.: Trust breaks down in electronic contexts but can be repaired by some initial face-to-face contact. CHI '98 Proceedings (1998) 496-502.
26. Bos, N., Olson, J., Gergle, D., Olson, G., & Wright, Z.: Effects of four computer-mediated communications channels on trust development. CHI 2002 Proceedings, 4 (2002) 135-140.
27. Chen, S. and Chaiken, S.: The heuristic-systematic model in its broader context. In Chaiken, S. and Trope, Y., Dual-process theories in social psychology (73-96). New York: The Guilford Press (1999).

Feeling Strangely Fine: The Well-Being Economy in Popular Games

Pippin Barr[1], Rilla Khaled[1], James Noble[1], and Robert Biddle[2]

[1] Computer Science Department,
Victoria University of Wellington, New Zealand
{pbarr, rkhaled, kjx}@mcs.vuw.ac.nz
[2] Human-Oriented Technology Lab,
Carleton University, Canada
robert_biddle@carleton.ca

Abstract. There is a growing interest in persuasive games designed to positively influence players' well-being in areas such as physical and mental health, particularly in terms of education. Designing such "well-being games" is challenging because games themselves have not been sufficiently examined from this perspective. Examining the ways popular games convey messages persuasively is an important step in understanding design in this area. By studying the popular domain we can derive considerations for the design of games targeted at promoting human well-being.

1 Introduction

Computer games which can be used to convey positive persuasive messages are a growing area of interest. Particularly desirable are games which promote human well-being, defined here as a "healthy, contented, or prosperous condition" [1]. The design of such games, however, is challenging for many reasons. Beyond obvious ethical and budgetary issues is the basic question of *how* games and gameplay can be used as a persuasive technology for human well-being.

Persuasive technology concerns "interactive computing systems designed to change attitudes or behaviours" [2, p.1]. Focusing on the *behavioural* aspect of this definition when considering computer games leads us to questions of *gameplay*. The gameplay of a computer game consists of a player's behaviour in the gameworld, as expressed through the user-interface, and the game's responses to this. To design a persuasive well-being game it is critical to identify how gameplay structures lead players to adopt, at least for the course of the game, particular values and behaviours.

After presenting background material in section 2, we offer a specific approach to exploring computer games based on the concept of a "well-being economy" in section 3. Next, in section 4, we use this approach to study four popular computer games. Examining the state of the art in this manner allows us, in section 5, to present insights into designing specific well-being games.

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 60–71, 2006.

2 Background

Sales of computer games in the United States topped seven billion dollars in 2004 [3]. Games such as *Halo 2*, which sold $120 million dollars worth of units on its first day [4], are inviting comparisons between the game industry and the movie box-office. The virtual world of the online game *EverQuest* was estimated to have the seventy-seventh largest economy in the *real* world based on real money spent in online auction houses for items, gold, and so on [5]. There can be little doubt that computer games are one of the most popular and influential forms of software in use today.

In his book *Persuasive Technology*, B. J. Fogg mentions computer games as a potential persuasive tool, positioning them largely as a form of operant conditioning [2]. Arguments about whether games influence real-world behaviour, such as aggression, have existed for as long as games themselves [7]. The idea that computer games are genuinely *persuasive* has led to considerable moral debate, such as the uproar over the "hot coffee" sexual content uncovered in *Grand Theft Auto: San Andreas* [6].

Research relating to persuasion in computer games includes analyses based on rhetoric [8] and ideology [9] as well as discussion of behaviourism in gameplay [10]. Attempts to use computer games in education have been around for some time, such as Thomas Malone's heuristics for motivational games [11], and continue to be of interest today, as in the work of James Paul Gee [12] and the *Education Arcade* [13].

One effect of the increasing acceptance of games as a persuasive or educational medium is that they are being used more "seriously." The United States military has developed the game *America's Army* quite specifically as a means to recruit potential new soldiers. The official website states that the game is intended to provide players with an experience of the army's values achieved in past times more directly via the draft [14]. The *Hubba Hubba Challenge* is a game developed for the New Zealand Government that promotes sexual health awareness in a game-like format [15]. The recent Serious Games Summit in Washington D.C. represents a major drive toward creating games for spheres other than "just" entertainment [16]. Whether games are a large or small factor in conveying persuasive messages, it is clear that interest in the area is only growing. It is also clear that little guidance for either design or analysis of such games is available.

3 Persuasive Gameplay: "Economic Analysis"

At their most basic, computer games involve a system of rewards and punishments based on a player's behaviour. This constitutes a primitive kind of *economy*, exchanging "work" for resources. In *Space Invaders* the player receives points for each alien invader killed, for instance. Many contemporary games, however, are considerably more sophisticated in how they create an economy related to player actions. These economies are central to convincing the player to adopt particular values and behaviours during gameplay. We suggest here a

small set of related concepts for use in analysis developed from a case study [17] and an extensive literature review. Although we focus on the specific value of "well-being" in this paper, it should be clear that this analysis is more generally applicable.

Action and Activity. Central to any understanding of behaviour, and thus persuasion, is *what can be done* in the game. In other words, it is necessary to examine the possibilities for action, from the most basic commands to the more complex activities that become possible in the context of the game-world. Simply put, the actions and activities available are a key indicator of behaviours valued in the gameplay economy, including those concerning well-being, because *this is how behaviour is produced*.

Valuables. All games present certain elements or items in play as being *valuable*, particularly in connection with the player's behaviour. At its most basic this parallels the rewards schedule found in operant conditioning, but it can also be more complex. By examining what is presented as valuable either through responses to actions or even explicitly quantified in the interface, we can build a picture of the game's system of valuables. Learning how well-being is positioned as a valuable is central to our project of understanding how it is more generally presented in gameplay.

Opposition. When considering what the gameplay is intended to persuade the player to do, we must also be aware of what is *opposed*. There are two basic considerations here: First, opposition is often presented as a challenge. This gives *meaning* to actions taken in the game by making them something to be *earned* through play. Second, if we intentionally play *against* the perceived nature of the game, we learn about how the game reacts to this. Such oppositional play uncovers negative evidence for a value like well-being by showing how playing against it is resisted [18].

Play and Progress. Both in our own work [17] and in the work of others [19], the values of "play" and "progress" are shown to be central to understanding gameplay of any kind. *Play* can be thought of as behaviour in the game for its own sake, while *progress* relates to behaviour specifically directed toward advancement. We can think of play and progress as being the basic "coin of the realm" of gameplay. To understand any persuasive message, such as one of well-being, we must seek to explore its relationship to these core gameplay values.

Using the above approaches to analysis we can examine games with an eye to how they portray values such as well-being. Such analyses yield insights concerning how the structuring of gameplay toward particular values leads players to adopt, at least during play, the associated behaviours.

4 Case Studies: Well-Being in Popular Games

In this section we present a case study of the value of *well-being* in four recent and popular computer games. The games are *Half-Life 2* [20], *Fable* [21], *Grand*

Theft Auto: San Andreas [22], and *The Sims 2* [23], each from a different genre. Respectively, they are a first-person shooter, a role-playing game, an action-adventure game, and a simulation. These genres emphasise quite different types of gameplay, from "fast-twitch" reaction-based gaming in *Half-Life 2* to the planning of domestic life in *The Sims 2*. For each game we apply the economic approach to analysis discussed in the previous section to the value of human well-being, defined as "health, contentedness, and prosperity."

4.1 Half-Life 2

Half-Life 2 places the player in control of the avatar Gordon Freeman, a man sent by a mysterious power to combat a fascist world controlled by the "Combine" ("The right man in the wrong place can make all the difference in the world"). The gameplay mainly consists of moving through a grey and desolate world killing enemy Combine soldiers in order to free the world from oppression.

The basic *commands* in the game consist of movement, either on foot or in a vehicle, and the use of weapons in combat. The weapons can *only* be used on enemies such as Combine soldiers and become non-functional when directed at non-enemies. In conjunction with the Combine's attempts to kill the avatar, the credo for action and activity is very simple: *kill or be killed*. Movement is highly restricted by the architecture of the game's levels: despite appearing free to move anywhere, the player can only direct the avatar along one path, killing those enemies who get in the way.

The system of *valuables* in *Half-Life 2* is as simple as the available actions. The core valuable is Freeman's *health* which is quantified as a number from one to a hundred, and is supplemented by an *armour* rating. These two numbers define well-being in the absolute sense. Further to this, well-being can be valued according to the fire-power at Freeman's disposal, a kind of combative "prosperity." More and more powerful weapons are required as he faces greater and greater threats to his well-being.

The gameplay of *Half-Life 2* is thus defined by *opposition* to Freeman's well-being. As the quip goes, "you're not paranoid, they really *are* out to get you." The game involves an almost non-stop assault on Freeman's well-being by Combine soldiers, aliens, helicopters, robots, and more. All standard gameplay is valued relative to *survival*, from health levels to access to weaponry. Despite this emphasis on survival, the importance of death is questionable. The sole in-game consequence of death is to be reincarnated at a slightly earlier point, and having to re-traverse the lost ground.

Attempts to play in any form of opposition to this basic economy of well-being are more or less impossible. Running from enemies is possible in the short term as a means of remaining alive, but becomes untenable as obstacles in the architecture are encountered and more enemies arrive. Short of hiding and refusing to move, which is decidedly *not* to play the game, there is no recourse but to move forward and shoot.

Half-Life 2 can be summed up as foregrounding an *economy of progress*. The core activity is to move forward in space, stepping over the bodies of fallen

enemies. Well-being is predicated on this form of progress because only by progressing to the end of the game will all threats to well-being be eliminated. With no-one left to kill, and no distance left to run, the game ends and Gordon Freeman is put back to sleep.

4.2 Fable

In *Fable* the player's avatar is a young man whose village has been destroyed and family either killed or captured by bandits. After training at the Hero's Guild he goes out into the land of Albion to complete various quests and to earn fame and fortune while saving the world from evil. A major feature of *Fable*'s gameplay is that the player can choose whether the avatar played is good or evil through their actions.

The basic *commands* in *Fable* concern combat (attacking with weapons or magic spells), movement through the world, or social interactions (such as marriage and drinking at the local pub). The core activity of the game is pursuing a series of predefined quests which advance the story. In addition, the game provides activities that are not directly tied to the quest structure, such as fishing, foot-races, or digging for buried treasure. The message conveyed by the available actions and activities in *Fable* is one of choice and freedom. Though a value of survival is still implicit in the commands for combat, there is also the suggestion of a more gentle prospering through fishing and so forth.

Well-being as "health" is, again, a central *valuable* in *Fable* and is quantified in a meter measuring the avatar's health level. Health is defended against threats using a variety of weapons and magic, or by wearing armour, and is maintained by using items such as health potions and food. As a role-playing game, *Fable* heavily emphasises the development of the avatar by *upgrading* health levels, improving dexterity in combat, and other key statistics which lead to greater success (largely in combat). The values associated with the avatar's skills in these areas represent the central valuable of the gameplay economy and are increased with Experience Points gained through combat. Combat thus becomes valuable largely as a matter of acquisition of points and other items, rather than as a matter of pure survival.

This suggests that well-being as *prosperity* is, in fact, the dominant concept. The game emphasises obtaining greater and greater levels of power through Experience Points, as well as the acquisition of properties, valuable items, clothing, and so on. The game also presents a system of Renown Points, again obtained largely in combat, which quantify prosperity by measuring how "famous" the avatar is in the world. The inhabitants of the world react to the avatar with everything from derision to awe.

Well-being is most fundamentally challenged by the various enemies who seek to kill the avatar in combat. When such encounters do end in the avatar's death, the game must be restored from the last save point. This can be inconvenient if a quest must be restarted, but is not of huge significance. Interestingly, the avatar's prosperity is essentially never threatened, as all items and wealth are restored

along with his life and cannot be lost during gameplay. Even the Renown points measuring fame do not diminish with time: once a piece of prosperity is obtained it is there forever.

Playing in *opposition* to the economy of combat, fame, and fortune *is* possible in *Fable*, unlike in *Half-Life 2*. Importantly, one *can* flee enemies successfully. More systematically, one can direct the avatar to settle down, get married, and to make money by fishing and running foot-races. The avatar's well-being is no longer threatened in any way, and a life of peace and quiet is attainable by simply refusing to participate in the combat side of gameplay. To do so, however, is extremely uncommon among players because one cannot *demonstrate* and experience the health and prosperity obtained in the game without fighting and completing quests.

Fable, in other words, is clearly a game emphasising a value of *progress*, and well-being as *prosperity* or successfulness in the world. Within the structure of quests, avatar development, and combat, however, the game offers a great deal of opportunity for *play*. As already mentioned, there are alternatives to combat such as fishing, digging for buried treasure, or perhaps getting married. Even experimentation with the avatar himself, whether it is his clothing, combination of skills, or alignment toward good or evil, is a form of playfulness within progress.

4.3 Grand Theft Auto: San Andreas

In *Grand Theft Auto: San Andreas* (*GTA:SA*) the avatar is Carl, an ex-gang member who has built a new life in another city ("I live in Liberty City now. I'm clean. Legit."). He returns home to Los Santos at his mother's death and is urged back into a life of crime by his family and gang. The gameplay takes place in an immense world of three cities and linking countryside and includes specifically designed missions as well as the ability to simply move about and pursue other objectives.

The basic *commands* of *GTA:SA* revolve around combat with weapons and movement in the world on foot, swimming, or in vehicles. Like *Fable*, the game offers a set of missions or quests which give a narrative structure to the game and are generally variations of "go to place *X*, kill group *Y*." There are also many other activities to engage in, far surpassing what is offered in *Fable*. Carl can play pool, compete in triathlons, attend driving school, climb a mountain to watch the sunrise, and much more.

As usual, the basic well-being *valuable* is Carl's level of health and armour along with his ability to defend them. These are maintained using special "medical packs," eating food, wearing armour, and, perversely, by sleeping with prostitutes. Well-being as prosperity within the game is valued largely in terms of the amount of money obtained, which is always displayed on-screen. This allows the purchase of property, clothing, and food, all pertaining to well-being as health and prosperity.

What is especially interesting about valuables in the game, however, is that far more important than any issues of health and survival is the pursuit of knowledge and achievement, presented as a prosperity for the *player* rather than the avatar.

Statistics in the game's menu system inform the player of everything from their top time in a motorbike race, to the number of enemy gang-members killed, to the amount of distance they have covered on foot. The most coveted statistic is "percentage of game completed": just how much the *player* has seen and done. The true valuables concern wealth of *experience*.

GTA:SA is interestingly characterised by a *lack* of serious challenges to well-being. While it is not uncommon for Carl's health-bar to reach zero, the effects are inconsequential. He is taken to hospital and restored to life, losing only his weaponry and any progress in the current mission, which are both trivial at most stages of the game. While there are threats to the avatar's continuous survival, it is never too difficult to avoid death, or to simply die and shrug it off. Whereas in *Half-Life 2* the objective of movement through space is to kill enemies, in *GTA:SA* the enemies are a hindrance to movement through space.

Instead, what the game provides is a world to explore and play in *without* much obstruction. Playing in opposition to the traditional play of survival and protecting well-being is not only possible, but *encouraged*. *GTA:SA*, in other words, is a game primarily of *play*. A common playing of the game involves exploration and experimentation with reference to the missions only when some external direction is desired.

The elements of *progress*, such as Carl's growing skills at driving or using weapons, come as a result of *play* rather than from any concerted effort to develop them. The wanton destruction engaged in by players is also quite playful, an experiment within the world of the game to see what can be done. Even the missions themselves, the most direct form of progress, are more to be played with than obsessively completed. Well-being in the game most crucially amounts to the well-being of prosperity: experiences the game offers, discoveries of hidden places and unexpected results.

4.4 The Sims 2

The Sims 2 has no quests or missions structuring its gameplay. Instead, the player tells a story by controlling the Sims, the virtual people in the gameworld. The Sims live in suburban environments and running their lives includes everything from birth to death, from trips to the bathroom to proposals of marriage.

The *interface* to *The Sims 2* is simple point-and-click and provides a wealth of possible interactions with objects in the home or with other Sims. These interactions vary from taking showers, to giving a daughter a hug, to playing videogames, to preparing dinner for the family. The game offers an immense scope for action in the limited context of a household. Because the game presents itself as a simulation of life, the well-being connoted by the commands available are those we might expect in real life: good relationships, good health, wealth, and so on. Well-being is represented positively, as something to be improved, rather than as something to be *defended* as in other games.

The core *valuables* of the game are indicated by *quantifications* of well-being. Coloured Need meters reflect the basic well-being of each Sim, covering everything from how full their bladder is to how hungry they are. A further measure,

called the Aspiration meter, quantifies the prosperity element of well-being: Sims have high-level wants and fears such as "getting a job in the Science Career" and "relative being left at the altar" which affect how prosperous they feel. Other quantifications also revolve around prosperity, such as the quality of relationships and skills possessed for performing jobs and household chores. Well-being is presented as a statistic to be manipulated by directing Sims to particular actions and objects: A Need such as "hunger" is improved by eating something from the fridge, and a Want such as "meeting someone new" is realised by inviting other Sims over. It is the player's responsibility to maintain and improve the Sims' well-being: "your guidance can help keep them in a good mood."

Challenges to well-being in *The Sims 2* come in the form of hunger, loneliness, kitchen fires, divorce, and so on. Further, a Sim is never truly satisfied: "When you satisfy a Want, a new one will take its place." Worst of all, a Sim might realise a Fear, such as being rejected for flirting, causing their Aspiration meter, and thus their prosperity, to drop. Gameplay is a constant battle, therefore, to keep the Sims' heads above water, and to keep striving for more and more happiness in the face of disruptions. In the worst case, a Sim can *die*. This is traumatic to a player because death is not presented as a natural part of gameplay. The game itself emphasises this in certain circumstances: "If the point of playing The Sims 2 was to kill off all of your Sims, then you would be the world champion! But, unfortunately, the way things stand now, The Sims 2 is still a LIFE simulator."

Playing in *opposition* to the basic understanding of well-being in *The Sims 2* is to pursue death and illness. Interestingly, this is perfectly possible and even perversely entertaining: A significant amount of content in the game is only seen when the Sims are desperately unhappy or even dead. Without opposing health and prosperity we would never see the giant Social Bunny who arrives when a Sim is depressed, or the Grim Reaper who calls heaven on his cellphone when a Sim dies. Despite these diversions, the name of the game is certainly still the pursuit of well-being in all its forms, and most of the game's experiences are accessed that way.

The Sims 2 is often described as a game of pure *play* whereas, in fact, there is a major emphasis on *progress* within this play. At any given point, for example, not all possible commands are available. Instead, the game presents a set of actions based on various elements such as relationship status and skill-sets. To make further actions available the game must be progressed through building relationships, learning new skills, and so on. Similarly, the player must advance careers, make money, and buy new possessions to experience as much as the gameplay as possible. The player is encouraged to play with *how* to progress, but measures of that progress are what define well-being in the game, from the length of a "social" Needs meter to the relationship rating a Sim has with her husband.

5 Discussion

In the above analysis of four popular computer games we have seen that each operates with a distinct economy of well-being in its gameplay. Further, it became

apparent that the games differ as to how well-being is presented and interacted with. Our objective in performing this study was to derive insight into the design of persuasive well-being games. In this section we discuss a number of themes from our analysis of popular games to begin to understand the possible representation of human well-being in gameplay.

5.1 Valuing Well-Being

The most dominant concept in our analysis was the uncovering of various *valuings* of well-being in gameplay, from the detailed quantifications of *The Sims 2* to the very basic "kill or be killed" of *Half-Life 2*. In all games, well-being was most basically defined by whether the avatar(s) lived or died, but this prospect was generally shown to be trivialised by the gameplay. In all but *The Sims 2*, death assumed a role of simple *inconvenience* because it was represented in the play as something to be expected. *The Sims 2* is a useful example in that it presents death as genuinely problematic.

Beyond the simple dichotomy of living versus dying, more complex attitudes to the valuing of well-being were present. The quality of *health* could be understood not only in terms of a measurement of how close to death the avatar was, but also in terms of access to health-promoting elements such as potions, food, armour, or recourse to the preemptive strike of combat. Similarly, notions of prosperity ranged from positioning within the simple hierarchy of weapons in *Half-Life 2* to the complex representations of relationships in *The Sims 2*.

The idea that higher level elements of gameplay, such as archery skill in *Fable* or driving ability in *Grand Theft Auto*, are tied to well-being as *health* within the game is powerful. This allows us to build up a less simplistic representation of health in gameplay, something that is affected not just by threats, but by more complex relationships connected with *prosperity* such as exercise or access to clean water. Even the most simplistic representation of health as a quantity is of interest because such metrics allow a player to consciously monitor it and to see immediately any impacts upon it.

The core message behind examining the systems of valuing well-being in these games, however, is that a significant degree of complexity is possible, culminating in the model offered by *The Sims 2*. It is not necessary to settle for "if you smoke then your character will die" as a well-being message. We can be more subtle while creating compelling gameplay, including considerations of exercise, peer support, and so on.

5.2 The Importance of Action

A critical point raised in the analysis was the centrality of *action* in the valuing of well-being. Well-being is only important as far as gameplay actions affect or are affected by it. The avatar's health is of central concern because if it is fully depleted the player is temporarily unable to act any further. Similarly, the representation of prosperity in the form of quests completed or relationship success is important because it is the *player* who brought these things about through their actions. In other words, any representation of well-being in a game

designed for its promotion must allow the player both to influence well-being through their play, and to have it influence their play in return.

In a well-being game design, then, we must focus on creating links between actions taken and well-being. A dietary game should allow a player not just to eat better in the gameplay, but to have this diet affect their avatar's fitness and consequently their performance in an activity such as a sport. Likewise, a game promoting an environmental concern such as recycling must not only present recycling in gameplay, but also the impact of this on the gameworld in terms of its appearance, for example. Better still would be to have the results of the player's recycling affect further gameplay, such as other characters joining in because of the example set. Players' actions should affect both the gameworld and their future play in order to tie well-being to the gameplay.

5.3 Play and Progress

In connection with the primacy of action are the place of the values of *play* and *progress* relative to well-being. Progress, particularly, is of central importance in terms of improving well-being through advancement of both health and prosperity. The avatar's well-being is often *progressed* with upgrades such as a new telescope (*The Sims 2*), an extra point of "toughness" (*Fable*), or a more powerful weapon (*Half-Life 2*). Concerning play, we find that well-being is a necessary *precursor* to successful play: the avatar, specifically, must be in good shape in order to playfully experiment with the gameworld. In games such as *Grand Theft Auto* simply playing within the gameworld actually led to enhanced well-being, such as the increase of particular skills. Further, opportunities for playfulness can be important for the player as a respite from a too-consuming drive for progress. Consideration of the *player's* well-being is important to consider, and was most obviously present as a form of prosperity through *achievement*, often linking the player's well-being with well-being in the game. This is evident in the statistical tracking of progress in *Grand Theft Auto*, the increase of power of the avatar in *Fable*, or the accumulation of belongings in *The Sims 2*.

In designing a well-being game, play and progress must be accounted for. Presenting well-being as something that can be progressed appeals to a player's sense of achievement. Making free play dependent on well-being also helps to make it more appealing. In a quit-smoking game we can value progress in terms of fitness gained by quitting smoking, and play by tying fitness to access to more activities. An issue surrounding the importance of progress, whether it is progression to victory or progression of the avatar, is that it does not necessarily map well to social messages of well-being. Although it makes sense to "win" against a smoking addiction, it is less clear that "beating" depression or racism makes sense.

5.4 Opposition

Our use of concepts of opposition helped in better understanding the meaning of well-being in the games analysed. Oppositions are part of the meaning of any concept: well-being as health, for instance, makes no sense without concepts of

"illness" or "death." Most of the games analysed had relatively unsophisticated representations of *not*-health: death. In order to adequately emphasise the *importance* of well-being, its opposite must also be present and possible. Additionally, as discussed, it is when well-being in any form is *challenged* that it becomes important, prompting the player to take action to protect it. When we played *Fable* by avoiding all confrontation, for instance, well-being as health became unimportant and uninteresting.

It is clear that in well-being games there will be a temptation to portray only the positive message, to avoid challenging the avatar's well-being, but this must be resisted. The mostly trivial nature of health in *Half-Life 2*, *Fable*, and *Grand Theft Auto* relates to its opposition, death, being relatively inconsequential in those games. Thus, in a game to quit smoking, for instance, it would be important to recognise relapses, cravings, irrational anger, and so on both as challenges to quitting and as results of "unsuccessful" gameplay. Oppositional play is an analytic tool we recommend applying to game designs to uncover what is opposed in the gameplay, and to thus gain a finer understanding of what the gameplay is *really* about ("what would happen if I just smoked a pack of cigarettes in the game now?").

6 Summary and Future Work

In this paper we have presented the idea of considering well-being in gameplay as a kind of "economy" and have suggested some approaches to analysis. This allows us to examine games in a more informed manner, and to uncover and assess particular elements of their structure. We analysed four popular computer games to explore their representation of well-being. Finally, we drew out a design considerations from this analysis intended to assist in the development of well-being games.

There is clearly much future work to be done in this area. More refined approaches to understanding well-being in existing popular games must be developed and applied to continue to build knowledge of the "state-of-the-art." A major aspect of computer games not discussed in this paper is *multiple players*, which surely must have a sizable impact on conceptions of well-being in gameplay. Finally, of course, persuasive well-being games must continue to be developed and played in order to understand what is and what is not successful in practice.

References

1. Brown, L., ed.: The New Shorter Oxford English Dictionary. Volume 2. Oxford University Press (1993)
2. Fogg, B.J.: Persuasive Technology: Using Computers to Change What We Think and Do. Morgan Kaufman Publishers (2003)
3. Entertainment Software Association: Essential facts about the computer and video game industry. ESA, `http://www.theesa.com/` (2005)

4. Becker, D.: 'Halo 2' clears record $125 million in first day. News.com, http://news.com.com/Halo+2+clears+record+125+million+in+first+day/2100-1043_3-5447379.html (2004)
5. Castronova, E.: Virtual worlds: A first-hand account of market and society on the cyberian frontier. Technical report, Center for Economic Studies and Ifo Institute for Economic Research (2001) Working Paper No. 618.
6. BBC News: No more 'hot coffee' sex for GTA. BBC, http://news.bbc.co.uk/2/hi/technology/4142184.stm (2005)
7. Griffiths, M.D.: Violent video games and aggression: A review of the literature. Aggression and Violent Behavior **3**(4) (1998) 203–212
8. Walz, S.P.: Delightful identification & persuasion: towards an analytical and applied rhetoric of digital games. In Copier, M., Raessens, J., eds.: Level Up Conference Proceedings, Utrecht, University of Utrecht (2003) CD ROM
9. Garite, M.: The ideology of interactivity (or video games and taylorization of leisure). In Copier, M., Raessens, J., eds.: Level Up Conference Proceedings, Utrecht, University of Utrecht (2003) CD ROM
10. Hopson, J.: Behavioral game design. Gamasutra, http://www.gamasutra.com/features/20010427/hopson_01.htm (2001)
11. Malone, T.W.: Heuristics for designing enjoyable user interfaces: Lessons from computer games. In: Proceedings of the 1982 Conference on Human Factors in Computing Systems, ACM Press (1982) 63–68
12. Gee, J.P.: What Video Games Have to Teach Us About Learning and Literacy. Palgrave Macmillan (2003)
13. Massachusetts Institute of Technology and University of Wisconsin: The Education Arcade. Website at http://www.educationarcade.org/ (2006)
14. United States Army: America's Army. Official Website at http://www.americasarmy.com/ (2006)
15. New Zealand Ministry of Health: No Rubba No Hubba Hubba. http://www.hubba.co.nz/ (2005)
16. CMP Game Group: The second annual serious games summit. Website at http://www.seriousgamessummit.com (2005) 31 October - 1 November.
17. Barr, P., Khaled, R., Noble, J., Biddle, R.: From pushing buttons to play and progress: Value and interaction in *fable*. In Piekarski, W., ed.: Proceedings of the Seventh Australasian User Interface Conference. (2006)
18. Barr, P., Marsen, S., Noble, J., Biddle, R.: Oppositional play: Gathering negative evidence for computer game values. In: Proceedings of the Second Australasian Conference of Interactive Entertainment. (2005)
19. Juul, J.: The game, the player, the world: Looking for a heart of gameness. In Copier, M., Raessens, J., eds.: Level Up: Digital Games Research Conference Proceedings, Universiteit Utrecht (2003) 30–45
20. Vivendi Universal: Half-Life 2. Developed by Valve for PC (2004)
21. Microsoft Game Studios: Fable. Developed by Big Blue Box Studios for X-Box (2004)
22. Rockstar Games: Grand Theft Auto: San Andreas. Developed by Rockstar North for PlayStation 2 (2004)
23. Electronic Arts: The Sims 2. Developed by Maxis for PC (2004)

Our Place or Mine? Exploration into Collectivism-Focused Persuasive Technology Design

Rilla Khaled[1], Pippin Barr[1], James Noble[1], Ronald Fischer[1], and Robert Biddle[2]

[1] Victoria University of Wellington, Wellington, New Zealand
{rkhaled, chikken, kjx}@mcs.vuw.ac.nz, ronald.fischer@vuw.ac.nz
[2] Human Oriented Technology Lab, Carleton University, Ottawa, Canada
robert_biddle@carleton.ca

Abstract. Persuasive technologies are increasingly ubiquitous, but the strategies they utilise largely originate in America. Consumer behaviour research shows us that certain persuasion strategies will be more effective on some cultures than others. We claim that the existing strategies will be less effective on non-American audiences than they are on American audiences, and we use information from interviews to show that there exists much scope to develop persuasive technologies from a collectivism-focused perspective. To illustrate the development of such a tool, we describe the design of a collectivism-focused financial planning tool.

1 Introduction

Persuasive technologies, "interactive computing systems designed to change attitudes or behaviours" [1] are becoming increasingly ubiquitous: they are utilised in areas as diverse as marketing, health, safety, environmental conservation, politics, religion, gaming, self-efficacy, occupational effectiveness, and empathy, amongst a long list of others [2, 1]. At the same time however, the majority of these applications are developed in the United States of America, destined for an American audience. As countries around the world have taken steps towards a fuller adoption of information technology, international software sales have risen dramatically [3]. In the past, international users often made do with localised versions of software originally developed for the American market. Slowly, however, the trend is changing so that software developers are taking cultural norms and assumptions into account. Because persuasion is related to cultural norms, it is important that persuasive technology developers do the same in designing and developing software destined for non-American markets.

While America is typically characterised as *individualist* [4], much of the rest of the world is described as *collectivist* [4]. In this paper, we use empirical

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 72–83, 2006.

information collected from interviews to show that there exists much scope to develop persuasive technologies from a collectivism-focused perspective. To illustrate how we may go about developing a collectivism-focused tool, we describe the design of a collectivism-focused financial planner tool.

The rest of this paper is structured as follows. Section 2 discusses culture, *individualism* and *collectivism* and their relationship to persuasion, as well as cultural biases in existing strategies. Section 3 summarises the findings of case studies conducted upon New Zealand persuasive technologies and services, highlighting limitations in the area of collectivist-focused appeals. Section 4 presents four design themes to consider when designing collectivism-focused tools, using the running example of a financial planner tool, and addresses some of the issues raised by the case studies. In section 5 we present our conclusions.

2 Background

2.1 Culture: Software of the Mind

Many definitions exist to explain the concept of culture. The definition proposed by Geert Hofstede, whose work has been highly influential in the cultural usability community, is the following:

> Culture...is always a collective phenomenon, because it is at least partly shared with people who live or lived within the same social enviorment which is where it was learned. It is the collective programming of the mind which distinguishes the members of one group or category of people from another [5].

Hofstede and other academics, including Harry Triandis [4], have established *cultural dimensions* (and related concepts), which are aspects of culture that can be measured relative to other cultures. One such dimension or construct that numerous academics have discussed is that of *individualism/collectivism*. From researcher to researcher, the exact details of the construct can vary. That which is broadly agreed upon is that the construct serves to describe general attitudes of societies, and not situation-specific attitudes of individuals.

Individualist societies are ones in which the ties between individuals are loose: people are expected to look after themselves and their immediate family only. Individual interests outweigh group interests, and individualists tend to be self-motivated and goal-oriented, using guilt and loss of self-respect as motivators [5]. Individualists also exhibit more attitude-behaviour consistency than collectivists, perform their duties if it is advantageous in terms of benefit, and have a self-identity that is defined independently of specific collectives [4].

In contrast, *collectivist* societies are ones in which from birth onwards, people are integrated into strong, cohesive in-groups, which are groups of people about whose welfare a person is concerned and separation from whom leads to anxiety. These in-groups protect their members in exchange for unquestioning loyalty. Group interests outweigh individual interests, and individuals strive to maintain

social harmony, adapting skills and virtues necessary for being a good group member and maintaining tradition. Shame and loss of face are typical motivators [5]. Collectivists exhibit less attitude-behaviour consistency than individualists, enjoy doing "what is right" for their collective, and have self identities that are strongly linked to attributes of their group [4].

Presently, most cross-cultural and consumer research focuses on these dimensions, indicating that they are believed to be the most important dimensions. Studies have also shown that these dimensions account for most of the variance in global differences [5, 4]. While multiple factors affect people's interactions with technology, these dimensions serve as a solid theoretical foundation for understanding persuasion-related behavioural patterns of global audiences.

2.2 Culture and Consumer Psychology Research

There has been considerable research in the domain of cross-cultural consumer psychology, investigating the general question of whether products should be advertised the same way around the world. Numerous findings indicate that from one market to another, tactics and strategies will need to be modified and adapted [6, 7]. Furthermore, the way persuasive messages are perceived and received are highly correlated to culture [8, 9].

2.3 Culture and Persuasive Technology Research

The understanding that culture affects persuasion has not yet received much attention from persuasive technology researchers. To date, most of this research has taken place from an individualist, American perspective: whether it be carried out by American researchers, or destined for an American audience.

This is problematic because America is reasonably *dissimilar* to the rest of the world: it has scored as the most individualist country in the world in various studies measuring worldwide individualist and collectivist tendencies [5, 10, 11]. Even when compared to other western countries, which also tend to be categorised as individualist, it seems distinct: competition and power hierarchies are more evident there [4], and values such as *ambition, daring, influential, successful, pleasure, exciting life,* and *varied life* are prioritised [12]. In contrast, most other individualist societies tend to be less competitive and hierarchical, and values such as *unity with nature, world at peace, protect environment, broad-mindedness, curiosity, freedom,* and *creativity* are given greater precedence [12].

Returning now to the more straightforward mismatch between individualism and collectivism, persuasive technology strategies originating from individualist cultures may not translate so effectively to cultures generally regarded as collectivist. Fortunately, it is reasonably easy for non-target audiences to identify *why* a persuasive appeal loses its "appeal" or *where* the persuasive message loses its relevance [13]. Unfortunately, unless designers are aware of their own cultural assumptions, beliefs, and behaviours, it is difficult for them to identify when they have unconsciously embedded these assumptions into their designs.

Our recent analysis of Fogg's seven persuasive tool strategies [1] showed that five of them favour individualist motivations over collectivist ones, while only

one favours collectivist motivations [14]. This is unsurprising, given that the strategies are presented as abstract summarisations of persuasive technology tactics currently in use in (predominantly) American tools. At the same time, it reveals the wide scope for research into the design of tools destined for collectivist audiences. In our earlier research, we focused on key findings in cross-cultural psychology literature about behavioural patterns of collectivists, and suggested a set of principled collectivism-focused persuasive technology strategies [15]. In order to obtain a more qualitative, empirical insight into persuasion tactics that would be successful in New Zealand (NZ), we carried out case studies on two prominent NZ social marketing organisations with online facilities.

3 Social Marketing Case Studies

When Hofstede profiled NZ in the late 1970s, his results described it as fairly individualist, and egalitarian in terms of power hierarchies [5]. The face of the NZ population has changed since the 1970s however. The 2001 Census [16], which allowed respondents to provide up to 3 non-mutually exclusive ethnicities, revealed that 76.9% of the population identify themselves as NZ Europeans, 14.1% of the population identify as Māori (the indigenous people of NZ), 6.2% identify as Pacific Peoples (originating from the Pacific Islands), while 6.4% of the population identify as belonging to an Asian ethnic group. Although New Zealanders of European descent can roughly be classified as individualist, Māori, Pacific Peoples, and Asian ethnic groups are generally classified as collectivist. The purpose of our case studies was to establish whether or not current social marketing policy in NZ reflects the multicultural nature of its people. For each organisation we interviewed four members in policy design and evaluation roles, brand communication roles, or upper management roles. One of the organisations, which we refer to as "Future", is primarily concerned with educating people about financial matters and retirement planning. The other organisation, "Support", is part of a larger health body focused on encouraging people to lead smoke-free lifestyles, especially Māori, who currently have the highest smoking rates of any ethnic group in NZ.

3.1 Beliefs About a Universal Message

Discussions with majority culture staff from Support and Future showed that while they were aware that context is important in grounding a persuasive appeal, there was a belief that the conveyed messages would be universally relevant:

> ...the messages we want to get across are the same for everybody but the mechanisms by which we want to get the messages across may differ... the content, the messages, everything's the same, the same mathematical principles apply. (Executive Director of Future)

There was also some hesitancy towards the idea of developing culturally specific versions, the justification given being that within-culture variation was too great to begin with:

> ...we're not going to treat [people of one] culture as one single entity that all think and act the same way. Within any culture there's such a variety of views and behaviours that it would be quite wrong to say, "Right, that's how Māori think", because there is a variety of views and approaches to life in Māori culture as there is in any other culture. (Executive director of Future)

Adding to the argument about diversity, one majority culture staff member explained why she thought customised service was a good solution:

> ...we acknowledge that people are very different.. it is not about saying "you should be saving for retirement" or "you should be doing this" or "you should be doing that", it's about providing education and information so people can make their own decisions... you're the one provided you've got all the information that then chooses to save or not to save or to pay off more debt or pay off less debt depending on what's really important to you... (Marketing communications manager of Future)

The above quote emphasises that the current Future approach prioritises customisation and personal empowerment, but relies heavily on *personal* responsibility. While personal responsibility is nurtured and encouraged in members of individualist societies, it is generally less actively developed in members of collectivist societies [4].

3.2 Questioning the Relevance of the Messages

An interview with a minority culture staff member of Support revealed a different opinion on the effectiveness of universal messages. The quote below illustrates his belief that messages pitched to individuals can lose their resonance by not taking family and community into context:

> ...there's a real risk of coming in at a national level and focusing on individuals and not really thinking about what we're trying to do...you can think about a person's behaviour in terms of the individual behaviour but that's also often influenced by their family and peer environment and sometimes the community environment. (Senior researcher of Support)

A contractor conducting a cultural audit upon Future, to identify communication gaps in reaching Maori and Pacific audiences, gave the following opinion on the cultural relevance of Future's persuasive appeals:

> ...we found little evidence of inclusiveness of language, of concepts, of media preference or attempts to understand the Māori and Pacific mindsets in relation to [Future]...most of what [Future] communicates registers financial issues from an ethnocentric perspective...which in turn alienates some Māori and Pacific audiences. (Cultural auditor of Future)

He went on to explain how the communication gap may have arisen as a result of *not* designating communication to different cultures as an objective.

> ...[Future] does not define communication audiences by ethnicity...it doesn't have any objectives to reach Māori and Pacific key audiences... the creative material therefore wasn't created to engage with Māori or Pacific people per se but generally it attempts to assimilate Māori and Pacific people as part of mainstream NZ...when you take a mainstream idea and thought and try and force it, it's like putting a square peg into a round hole, it just doesn't work. (Cultural auditor of Future)

The Future cultural auditor did, however, believe that there was a way to develop more culturally-relevant persuasive appeals:

> ...tap into the cultural capital and those values and mindsets and you can be well on your way to connecting a lot stronger... (Cultural auditor of Future)

It is interesting to reflect on how the opinions of minority culture staff do not mesh with those of the majority culture staff. While the majority culture staff members were indeed *aware* that cultural context can affect the relevance of a message, it seems that they were unable to see just how much cultural context really does affect a message, or where cultural context ends and the message begins. Furthermore, majority culture staff believed that empowering individuals and improving means of customisation would be a solution to dealing with diversity, whereas minority culture staff argued that people of minority cultures expect minority culture values and social structures to be referenced.

3.3 Integrating Collectivist Beliefs into Policy

The most recurring theme to emerge in discussions on how to develop more persuasive campaigns for minority cultures was *leveraging existing social networks*, for example, family, communities, and tribal groupings. Said one Support member about what he thought campaigns should include:

> ... a facilitation process where the whole community comes together and operates in a bigger way and identifies the issues that they see important and comes up with solutions and they engage in making changes. (Senior researcher of Support)

While this type of suggestion might feasibly be made by someone from an individualist society, the Future cultural auditor explained why group-centric motivations are likely to be *more* effective amongst collectivist society members than motivations based on personal improvement:

> ...they have a collective responsibility towards issues...their priorities are collective responsibilities rather than "I've gotta look after myself at all costs"...this means that service to others is more acceptable than looking after yourself first, service is thought of both as a burden and as an honour. (Cultural auditor of Future)

In fact, Triandis claims that the question of whether collective needs and responsibilities over-ride personal needs and responsibilities is one of the most fundamental identifiers of whether societies are individualist or collectivist [4].

Another significant theme that surfaced was the importance of getting minority culture target audiences to feel that they were in control of the messages themselves, or that they had *ownership* of the messages. The following is an extract of a discussion with the Future cultural auditor about a NZ transport safety social marketing campaign, which he believed was an example of successful communication with collectivist audiences:

> ...get the community to work with you...what's developed from it is that the community started to own the messages, started to take responsibility and started to enforce some drink drive issues, or road saftey issues and that's an example of how the process can change, still doing the same thing, but just changing the process. (Cultural auditor of Future)

A Support affiliate talked about how her particular branch of Support, which focuses on Maori audiences, makes use of existing family and community links to deliver a strong, well supported and encouraging message:

> When you think about Māori it's about whanau[1], about family, it's about that greater family, it's about iwi[2], it's about your hapu[3], it's about all these people working together so that's how we we work to support each other for the greater good of the people...so we support the community which then supports the health worker in their relationship with that person in the community or that marae[4], so it's not about "me" it's about that community base working, like a three way partnership. (Campaign manager of Support)

The components of the three-way partnership the Support staff member mentions above are the message *senders*, the message *recipients*, and the *community of the recipients*.

4 Designing Collectivism-Focused Tools

So far, there has been little exploration into the idea of designing persuasive technologies with particular cultures in mind. The case study data discussed previously reveals that culture can act as a strong differentiator in how people perceive and react to persuasive appeals. Furthermore, it gives us insights into how we may develop persuasive technologies to form a better fit with collectivist mindsets. Here we discuss four of these insights.

[1] *Whanau* as a concept loosely corresponds to "family", however it can be inclusive of distant relatives and friends.

[2] *Iwi* roughly corresponds to "tribe", "clan", and sometimes "backbone".

[3] *Hapu* refers to a social grouping smaller than iwi, so it may be conceptualised as a "sub-tribe".

[4] *Marae* is the sacred area of land in front of a traditional meeting house.

A collectivism-focused financial planning tool
To ground our discussion of design themes, we use a running example of a hypothetical financial planning tool. Similar to the tool Future provides, our example tool aids people in recording and managing their expenditures, performs calculations surrounding paying off mortgages and debts, suggests realistic payment plans, and records and sends out reminders about financial goals. Unlike Future's tool, our financial planning application is designed for a collectivist audience.

4.1 Group Customisation

Our interviews continuously highlighted the fact that collectivists tend to think of themselves primarily in the context of *other in-group members*. In some ways this runs at crosscurrents to the present marketing trend in the West of developing more personally customisable products. However customisation can be applied at a group level rather than a personal level, as from a collectivist perspective the *in-group* forms the basic social unit rather than the individual [4]. In the same way that individuals from individualist societies have a good understanding of their own personal needs and preferences, collectivists understand the needs of their in-groups. Group customisation will probably carry more resonance for many collectivists than personal customisation.

In turn, the customisation focus on group identity will help foster a sense of message ownership: by framing desired outcomes in terms of the group and group identity, the persuasive aims should feel less imposed and instead more in-line with the group's own ambitions. At the same time, users can feel like they are playing a part in upholding collective responsibility, as they will be working together with other in-group members to achieve group goals.

In terms of the financial planning tool, instead of having profiles that exist for individuals, there could be a group profile, which may describe an in-group or family/extended family. We believe maintaining group profiles seems like a feasible concept since the case study information showed that Māori and Pacific Peoples think of money in a more communal manner than do New Zealanders of European origin, in the sense that there is a cultural expectation that one's money will help support extended family. Individual members may still be described, but they will be affiliated to larger group profiles. Each group profile may contain details such as combined incomes, investments, debts, along with the group's financial goals, goal priorities, links to other group profiles, other profiles the group forms a part of, and so on.

4.2 Opinion Sharing

Since collectivists are motivated by a sense of collective responsibility, it is important that they have a sense of where that responsibility lies, and what the beliefs of the in-group are. Often software applications will require users to make decisions resulting in various outcomes, and without access to opinions of in-group members about what course of action to take, the decision making process for collectivists may be time-consuming, and potentially stressful. For example, one study showed that Chinese online shoppers felt more comfortable making online

transactions if they felt they had the support of relevant social groups, whereas societal support had less of an impact on American buying intentions [17]. We propose adding facilities to the tool which would allow users to find out about what the other in-group members' opinions are with regards to various topics. These facilities may encompass opinion databases, notes, logged chat sessions with other online group members, trends in group preferences identified from linked individual and group data, graph and chart displays, etc.

Giving users the option to view the opinions of other group members will enable them to feel more connected with the rest of the group. This sense of group connection is important, as collectivists place significant trust and respect in the opinions of in-group members [8, 5, 4]. Furthermore, being reminded of the existence of the group in a setting where the user is not physically nearby other group members may add to feelings of security and support. Also, social comparison theory shows that people of *any* culture tend to be naturally interested in the opinions and progress of others, as they are constantly benchmarking their own behaviours against those of others [18]. Nardi also discusses this in-built inquisitiveness in her writings about why people blog [19].

In the financial planning tool, prior to making any significant changes to goal setting plans, for example, users might be asked if they want to review recent discussion in their group's own chat room about goal setting. They might also be shown a pie chart of the opinions of other in-group members about what course of action to take. They will also be asked to record their own opinion on what to do, and upon making the decision, why they took the course of action that they did. The next time someone else in the group makes a decision regarding goal setting, these recently recorded opinions will be useful.

4.3 Monitoring/Mentoring

Fogg's *self monitoring* strategy describes tools that allow people to monitor themselves to inform them about how they might modify their attitudes or behaviours to achieve a related goal or outcome [1]. Another of his strategies, *surveillance*, describes allowing one party to monitor the behaviour of another party through observation, as when people know they are being watched they tend to behave differently [1]. While self monitoring hardly ever raises any objections, surveillance is often perceived as sinister. From a collectivist perspective however, people constantly measure their own performance via the impressions and assessments of other in-group members [5, 4]. Merging the concepts of self-monitoring and surveillance approximates the effects of a collectivist being "monitored" by her in-group. Although she is being monitored by other people, since she identifies so closely with her in-group, the group identity strongly shapes her own identity, and *group* monitoring equates more closely to the much less sinister *self* monitoring.

One of the ethical questions surrounding surveillance concerns allowing an individual or a group to obtain information about another individual or group. The issue is mitigated, however, if the individual under surveillance is happy for this information to be shared, which is more likely to be the case for collectivists

with regards to their in-group members. Additionally, our interviews showed that collectivists are accustomed to relying on community support mechanisms to maintain life changes. This is akin to mentoring programmes, except with the in-group substituting for a single mentor. Group rewards systems could also be integrated into tools, whereby everyone who collectively worked towards a goal would be rewarded, thus harnessing elements of positive reinforcement learning.

Incorporating the monitoring/mentoring approach into the design of the financial planning tool, users could be given the facility to track all major expenditures, and perform forecast calculations etc., to see how they are progressing towards helping achieve group goals. Everyone in the group might have access to everyone else's expenditure records, and can leave encouraging notes and messages, calling into effect normative influence and social comparison, which have long been acknowledged as powerful motivators [20, 18]. Furthermore, knowing that everyone has access to everyone else's records might make people pay closer attention to their spending habits, as people tend to act differently when they believe they are being watched [21]. While is it true that collectivists are generally *always* motivated to behave in a manner that best suits their group [4], being aware of the existence of records detailing spending habits may highlight the urge to act in accordance with the group.

4.4 Polychronic Time

Hall claims that time systems are *monochronic* in individualist societies and *polychronic* in collectivist societies [13]. So while individualists tend to see time as linear, do things sequentially, and value time-based schedules, collectivists perceive time to be less tangible and prioritise the involvement of people and completion of transactions above adhering to preset schedules [13]. In terms of goal setting and tools developed to facilitate the completion of goals, this means that linear timelines may not be so useful for collectivists since goal completion may be contingent on the occurrence of various other events. Instead of a straightforward linear timeline, we suggest using multiple linked, parallel timelines with flexible concepts of time, ordered in terms of transactions, events and goals, and their relative priorities.

Framing transactions, goals and events in terms of linked, parallel timelines relates to how collectivists achieve progress in group settings: one person may feel uncomfortable proceeding with an action before another event has occurred [13]. Constant negotiation is often needed to maintain ongoing progress [5, 4, 13]. Explicitly recording these linkages, contingencies, and priorities facilitates negotiation and provides everyone in the group with an accurate view of progress.

Applying this to the design of the financial planning tool, we could provide a facility for storing and modifying financial goals that would save information about goals, goal priorities, rough completion time frames, necessary negotiation between group members, and linkages between various goals. The tool would have various display options for viewing the goals (text based display, flow-chart style graph, etc.) and would also save the goal information for other calculations.

Discussion
Given that these themes rely on the existence of a cohesive group, it is important that group members themselves feel comfortable sharing personal information with other group members. A participatory design approach involving end-user discussions about information sharing could be used in developing applications of this type, to establish what types of information end-users are willing to share. We also suggest that actual users always be notified of what types of information will be shared *prior* to any sign-up processes.

Also, like other persuasive technology strategies, the design themes we have discussed could equally be used in tools viewed as *unethical*. For example, they could be used in a collectivism-focused online gambling savings account, offered to users as a helpful and easy way to put money aside for online gambling. To this end, we urge designers to follow Berdichevsky and Neuenschwander's "golden rule": *creators of a persuasive technology should never seek to persuade anyone of something they themselves would not consent to be persuaded of* [22].

5 Conclusion

Public awareness of persuasive technology is increasing, but to date it has been developed to cater towards individualist audiences. Cross-cultural and consumer psychology research shows that from culture to culture, and more broadly from individualism to collectivism, people react differently to the same appeals. Case studies on social marketing organisations and persuasive technology designers in NZ reveal that while some minority culture members believe a communication gap exists, majority culture members often do not perceive the gap.

As a solution, we proposed designing persuasive technology from a collectivist perspective, looking to dominant themes in our case study data and cross-cultural psychology for guidance. Using a financial planning tool as an example, we suggested four themes for collectivism-focused persuasive technology design: *group customisation*: customisation at a group rather than individual level; *opinion sharing*: incorporating facilities to store and display opinions of group members; *monitoring/mentoring*: where the group acts together to monitor relevant behaviours; and *polychronic time*: using multiple linked, parallel transaction-based timelines in place of more standard linear timelines. Our future plans for this research involve developing an "individualist" and "collectivist" version of a persuasive application, which we will trial on individualist and collectivist audiences. Using attitude change measures, we will establish which version of the application each audience perceives as more persuasive.

References

1. Fogg, B.J.: Persuasive Technology: Using Computers to Change What We Think and Do. Morgan Kaufmann Publishers (2003)
2. King, P., Tester, J.: The Landscape of Persuasive Technologies. Communications of the ACM **42** (1999)

3. Yeo, A.W.: Global-software Development Lifecycle: An Exploratory Study. In: Proceedings of the SIGCHI conference on Human factors in computing systems, ACM Press (2001) 104–111
4. Triandis, H.: Individualism and Collectivism. Westview Press (1995)
5. Hofstede, G.: Cultures and Organisations: Software of the Mind. McGraw-Hill Education (1996)
6. Han, S.P., Shavitt, S.: Persuasion and Culture: Advertising Appeals in Individualistic and Collectivistic Societies. Journal of Experimental Social Psychology **30** (1994) 326 – 350
7. Tansey, R., Hyman, M., Zinkhan, G.: Cultural Themes in Brazilian and US Auto Ads: A Cross-Cultural Comparison. Journal of Advertising **19** (1990) 30 – 39
8. Aaker, J., Maheswaran, D.: The Effect of Cultural Orientation on Persuasion. The Journal of Consumer Research **24** (1997) 315 – 328
9. Gurhan-Canli, Z., Maheswaran, D.: Comparative Advertising in the Global Marketplace: The Effects of Cultural Orientation on Communication. William Davidson Institute Working Papers Series 328, William Davidson Institute at the University of Michigan Business School (2000) available at http://ideas.repec.org/p/wdi/papers/2000-328.html.
10. Triandis, H.C., Bontempo, R., Villareal, M.J., Asai, M., Lucca, N.: Individualism and Collectivism: Cross-Cultural Perspectives on Self-Ingroup Relationships. Journal of Personality and Social Psychology **54** (1988) 323 – 338
11. Kluckhohn, F., Strodtbeck, F.: Variations in value orientations. Row, Peterson (1961)
12. Schwartz, S.: Mapping and Interpreting Cultural Differences around the World. In Vinken, H., Soeters, J., Ester, P., eds.: Comparing Cultures. Brill (2004)
13. Hall, E.: Beyond Culture. Anchor Press/Doubleday (1976)
14. Khaled, R., Noble, J., Biddle, R.: Developing culturally-aware persuasive technology. In Gado, E.D., ed.: Proceedings of the 7th International Workshop on Internationalisation of Products and Systems. (2005)
15. Khaled, R., Biddle, R., Noble, J., Barr, P., Fischer, R.: Persuasive interaction for collectivist cultures. In Piekarski, W., ed.: Proceedings of The Seventh Australasian User Interface Conference. (2006)
16. Statistics New Zealand: 2001 Census. `http://www.stats.govt.nz` (2002)
17. Pavlou, P., Chai, L.: What Drives Electronic Commerce Across Cultures? A Cross-Cultueral Empirical Investigation of the Theory of Planned Behaviour. Journal of Electronic Commerce Research **3** (2002) 240 – 253
18. Festinger, L.: A theory of social comparison. Human Relations **7** (1954) 117 – 140
19. Nardi, B.A., Schiano, D.J., Gumbrecht, M., Swartz, L.: Why we blog. Communications of the ACM **47** (2004) 41–46
20. Kitayama, S., Burnstein, E.: Social Influences, Persuasion, and Group Decision Making. In Brock, T.C., ed.: Persuasion: Psychological Insights and Perspectives. Allyn and Beacon (1994) 175 – 194
21. Turner, J.: Social Influence. Open University Press (1991)
22. Berdichevsky, D., Neuenschwaner, E.: Toward an Ethics of Persuasive Technology. Communications of the ACM **42** (1999)

Persuasion Artifices to Promote Wellbeing*

Fiorella de Rosis[1], Irene Mazzotta[1], Maria Miceli[2], and Isabella Poggi[3]

[1] Intelligent Interfaces, Department of Informatics, University of Bari
{mazzotta, derosis}@di.uniba.it
[2] Institute of Cognitive Sciences and Technologies, National Research Council, Roma
maria.miceli@istc.cnr.it
[3] Department of Education, University of Roma Tre
poggi@uniroma3.it

Abstract. We propose a theory of a-rational persuasion in which we integrate emotional and non emotional strategies by arguing that they both imply reasoning and planning abilities in the two participants. We show some examples of texts from a corpus of persuasion messages in the healthy eating domain and propose a formalism to represent this knowledge. The final goal of our research is to simulate user-adapted persuasion dialogs about healthy eating.

1 Introduction

Eating habits are an essential component of wellbeing which result of cultural, psychological and educational factors. As such, they consolidate in time and, when wrong, are quite difficult to modify. Information media are masters in employing tricky arguments to persuade the population to consume products of doubtful healthiness. Attempting to contrast this pressure to persuade the population to adopt more appropriate habits by employing only 'rational' and 'scientific' arguments is probably not effective. This is, therefore, one of the domains in which mingling of rational and emotional strategies are justified if not needed. Of course, as suggested by Walton [1], attention should be paid to insure that arguments are relevant and strong: this is a subjective judgement which depends on the persuader's personality and on the context.

In this paper, we propose a method to formalize and represent persuasion strategies as oriented graphs, and show how emotional and non emotional strategies (and also emotional and non emotional components in the same strategy) may interact with, and strengthen, each other. Our theory of a-rational persuasion is outlined in Section 2. A corpus of persuasion messages in the domain of healthy eating is taken as a reference to test our theory and formalism: in Section 3 we describe how we collected this corpus and in Section 4 how we analyzed it. In Section 5, we address the role of uncertainty in persuasion strategies and show how it can be represented in oriented graphs. Section 6 concludes the paper with by briefly pointing to related work.

* This work was financed, in part, by HUMAINE, the European Human-Machine Interaction Network on Emotion (EC Contract 507422).

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 84 – 95, 2006.

2 Theoretical Background

A relevant issue in the domain of natural argumentation and persuasion is the interaction (synergic or conflicting) between 'rational' or 'cognitive' modes of persuasion and 'irrational' or 'emotional' ones [2]. Miceli et al [3] proposed a model that takes the persuader's P perspective: the model focuses on P's theory of the recipient's R mind and P's planning strategies for influencing R, that is for changing her mental state so as to make her intend to do a certain action or plan. Our notion of persuasion was circumscribed in relation to further criteria, such as the intentionality of P's persuasive attempt, the use of (verbal or non verbal) communication, and the use of non-coercive forms of influencing. To define a process as persuasion we do not view as necessary that the Recipient is in fact finally persuaded; rather it is necessary that P has the intention of inducing an intention in R, that P does so through communication (subliminal persuasion is out of our definition), and does so in a non-coercive way, that is, by letting R freely conceive that intention or not. Conversely, persuasion can be carried on either by being sincere or through deception, and for either selfish or altruistic purposes; so, it can be either a manipulative or a non manipulative way of influencing people.

We built our theory on Toulmin's theory of argumentation [4] and on further developments [5], in particular Walton's *argumentation schemes* [6, 7]. A qualifying feature of our model is the attempt to integrate emotional and non emotional persuasion. As its non emotional counterpart, emotional persuasion is aimed at generating, activating or increasing the strength of R's goals, so as to induce in R some intention instrumental to such goals [8]. The specificity of emotional persuasion lies in the means used for accomplishing this task. That is, when using an 'emotional' strategy, P tries to generate, activate, etc. R's goals through the medium of either R's emotions or R's beliefs and goals *about* her emotions.

Actually, any appeal to emotions is grounded on the strict and manifold relationship between emotions and goals, which is, so to say, 'exploited' by a persuader. At least three kinds of relationship between emotions and goals can be identified. First, emotions signal the destiny (i.e., the possible or actual thwarting or achievement) of our goals, thus accomplishing an informative function about our relationship with the environment (e.g., [9,10]). Second, emotions generate goals. Once an emotion has signalled the achievement or failure of a goal, generally a behavioural response follows, implying the production of some goal (of either the approach or the avoidance type). For instance, fear signals the presence of a danger, and generates the goal to avoid it. Third, emotions 'become' goals: an action may be performed *in order* (not) *to feel a certain emotion*. For instance, I may give you a present to feel the joy of making you happy; or do my own duty not to feel guilty. Hence the important role emotions play in learning: an action can be performed (or avoided) not only in view of its outcome, but also in order (not) to feel the associated emotions.

We identify two general modes of emotional persuasion, which are grounded on such relationships between emotions and goals: *persuasion through actual arousal of emotions* and *persuasion through appeal to expected emotions*. In persuasion *through arousal of emotions*, the generative relation between emotions and goals is exploited. For instance, P's saying to R *'How disgustingly fat you are!'* is meant to provoke R's shame, which should generate R's goal of not losing her face and induce, as a means

for this goal, her intention to go on a diet. In persuasion *through appeal to expected emotions*, the goal-like quality of emotions is exploited, by acting on the recipient's goal (not) to feel a certain emotion. For instance, P's saying to R *'If you are kind to John, you will feel at peace with your conscience (or you will not feel guilty)'* is meant to activate R's goal to feel at peace with her conscience (or not to feel guilty), in order to induce in R the intention to be kind to John as a means for it.

We argue that the rational/irrational, as well as the argumentative/non argumentative dimension, do not allow to distinguish such forms of persuasion from the non emotional ones. In particular, one mode of emotional persuasion, the *appeal to expected emotions*, can be perfectly rational, as long as 'rational' implies the correct processing of the information available, the derivability of conclusions from premises, and the production of plausible means-ends relationships. An appeal to expected emotions is 'structurally' indistinguishable from any other 'argument from consequences', as defined by Walton[1] [7]. The only difference resides in the *content* of the goal on which P acts: in the appeal to expected emotions, this content is precisely that of 'feeling' a certain emotion rather than having a certain state of the world true. The other mode of emotional persuasion – *persuasion through arousal of emotions* – works differently from the former, in that the aroused emotion (say, shame) can directly produce a certain goal (say, to save one's face), independent of R's reasoning and planning about means-ends relationship. Therefore, this is no doubt a form of non argumentative persuasion. However, in this context 'non argumentative' should be made equal to 'a-rational', rather than 'irrational' (as long as 'irrational' implies going *against* the dictates of reason). Moreover, it should be stressed that the direct production of a goal through emotional arousal is just one step which is generally included in a more complex persuasion strategy expecting a very 'rational' planning and behaviour on R's part. That is, once a certain goal is emotionally produced, R's reasoning and planning can be called into play in view of its achievement. For instance the goal to save face, together with the belief that being in shape is a means for achieving it, is likely to generate R's goal of being in shape, and the consequent planning as a means for achieving it. Thus, even such a form of persuasion is partially based on the recipient's reasoning and planning abilities, which testifies to the constant mingling and intertwining of rational and a-rational ingredients in most persuasion strategies.

3 A Corpus of Persuasion Messages About Healthy Eating

To assess which artifices are employed by people with no particular competence on healthy eating education, we collected a corpus of persuasion messages with a website (http://www.di.uniba.it/intint/H-persuasion-bi.html). A scenario was presented initially to describe the situation which the subjects participating in the study (the 'persuaders') should imagine to find themselves in:

---

[1] *Walton's Argument from (Positive or Negative) Consequences* is formulated as follows:
PREMISE: If A is brought about, then good (bad) consequences will (may plausibly) occur;
CONCLUSION: A should (not) be brought about.
(Plus a list of 'critical questions'). As we will see later on, we add to this schema some more conditions, to specify when the conclusion should hold.

"Mary, one of your best friends, is a 25 year old girl who follows a wrong diet. She does not eat much fruits and vegetables while tends to overeat meat, sweets and pasta. Try to persuade her to eat more fruits and vegetables and, in doing so, don't forget that Mary is famous for her obstinacy! You know the following facts: eating fruits and vegetables is good for health. They are good sources of vitamin A and C, which are important for growth and repair of body tissues, to cleanse the blood and give resistance against colds. Moreover, various epidemiological studies proved that a diet rich in vitamin A and C decreases the risk of coronary heart diseases and stomach cancer. In addition to those facts, consider that health is very important for Mary: she likes sports, undergoes periodical check ups and looks at TV programs about health care. Mary would have enough free time to cook vegetables and delicious fruit dishes. Please, use this information to write a text (from 5 to 10 lines) to argue about your thesis."

The scenario was formulated to suggest the following keypoints in planning a specific strategy:

- Friendship relation between persuader P and recipient R (Mary in the previous example)
- R's personality (to be obstinate)
- R's goal (to be in good health, in the previous scenario)
- R's living habits (makes sports, undergoes checkups, looks at specialized TV programs)
- Holding of conditions to do the action p (R has time to prepare vegetables)
- Relationship between desired action (eat vegetables) and likelihood to achieve R's goal.

Cognitive dissonance was implicitly assumed in R's mind. The hypothesis was that, in conditions of cognitive coherence, the intention to perform some action should be a consequence of a set of beliefs, goals and conditions which make the action possible. In the scenario, on the contrary, premises were presumed to be true while the consequence was not. This case of cognitive dissonance was similar to the smoking example originally formulated by Festinger [11]. Four variations of this scenario were displayed randomly to the subject, which differed in two variables: employing positive vs negative arguments and mentioning consequences on health vs appearance. The previous scenario corresponds to the 'positive arguments' and 'mentioning consequences on health' condition. We collected, overall, 33 messages from subjects aged between 23 and 63, of both genders, with various backgrounds. The three variables (age, gender and background) were not statistically associated. In the next Sections we will examine these texts very shortly to single out variations in strategies and to reason on their possible formalization.

4 Outline of Corpus Analysis

We start from the hypothesis that, in conditions of cognitive coherence, the following implication holds: *if a given goal is of high value to R and is active in her mind, and R*

believes that doing a given action implies achieving the goal and that conditions hold to do the action, then R has the intention to do that action.

The main goal (the claim) of a persuasion message is to *recommend the activity* by strengthening the intention to perform it. This goal may be achieved by combining various techniques which take, as their target, different items in the previous implication:

1) attempt to *increase the desirability of the outcome*;
2) attempt to *convince about activity-outcome relationship*;
3) attempt to *prove that conditions exist for performing the activity*.

In addition, it has been claimed that *being aware of a cognitive dissonance* between own beliefs and intentions may produce a motivation that results in genuine cognitive changes [11]; therefore, specific reference to inconsistency between the referents' beliefs and goals and their behaviour can also be made to strengthen the persuasiove power of a message. In attempting to produce a motivation based on *evoking the cognitive dissonance,* the target is the inconsistency between the receivers' set of beliefs and goals and their behaviour.

We analyzed the texts in our corpus by trying to find out whether and how each of these techniques was implemented. Let us start with a first example[2]:

Mary, I believe you should eat more fruits and vegetables.
Aim: recommend the activity.

By making sport, you should know that vegetables are good for health! They strengthen muscles and bones as they are rich in minerals.
Aim: convince about activity-outcome relationship.
The rational strategy adopted is enriched by exploiting evidence about the referent which proves her believing in the relationship ('by making sport, you should know…").

Especially after making sport, a good quantity of fresh season fruit tonifies and rehydrates the body after the big toil!
Same aim and target as in the previous sentence.
Emotional items are introduced in the style ('fresh season fruit', 'big toil': 'faticaccia', in Italian)

Without counting the benefits of vitamins A and C for skin and hair!
Always the same aim and target

Maybe you might get rid of some portion of meat or sweets, to leave more space to fruits and vegetables!
The persuader suggests a plan to implement the activity.

This text is very simple: it is a nearly rational message that we will take as a reference schema in our next analysis. However, very few of the messages in the corpus were formulated according to this schema. This occurred primarily when the subject's background was scientific (computer science in particular, with no gender difference); on the contrary, the majority of subjects with a humanistic background employed more refined and emotional techniques. An example of *persuasion through arousal of emotions* that we defined in Section 2: by saying "... you pretend you care for your health!, or...a person like you, who cares so much for her health!", the subject aimed at

[2] Translated from Italian: we apologize to our subjects for the bad translation of their very rich texts!

arousing in Mary the emotion of shame by pointing to her incoherent behavior, in order to produce the goal to save face and therefore to care more for her health, as a means to this superordinate goal. Examples of *appeal to expected emotions* were also frequent. For instance, by saying: "...try to think, Mary, how much more beautiful you might appear and be!" the subject aimed at appealing to Mary's emotional goal to feel attractive. In several cases, the two persuasion techniques were enriched with other a-rational ingredients. For instance:

- persuasion through arousal of emotions was frequently based on evoking explicitly the *cognitive dissonance* mentioned in the scenario, with the intention to arouse the emotion of shame (and therefore, the goal of saving face) in a Recipient who is (presumably) sensitive to the value of consistency. See the previous examples, and also "…And you, who care so much for being well, you don't think to that?";
- *higher-order goals* were introduced in the text, such as 'to live in a natural way', 'to satisfy gluttony', 'to enjoy', 'to make friends'. For instance: "...you would contribute to the life of biological peasants, or ...you may always enjoy in preparing gorgeous vegetable meals."
- more or less explicit *appeal to emotions* was made in some cases: "here is the sagacity of experienced women: you have the creative intelligence on your side... *(pride),*...I would be delighted to meet you and discuss pleasantly with you... *(attraction).*
- the *recommend the activity* section was usually introduced at the beginning of rational texts but only subsequently in less rational ones, after preparing the subject to receive the message. In some cases, this recommendation was substituted with the description of some tempting consequence of the activity: "...tomorrow you invite me at home for dinner and we only eat vegetables and fruits, OK?".
- *proofs that conditions existed for making the activity* was given, sometimes, in emotional form: "...you, who have time and may enjoy preparing food..." or "...as you have time at your disposal, ...you may find some excellent vegetables and fresh fruits!".

The adoption of various sorts of persuasion techniques proves that our subjects did not consider each of them sufficiently strong per se, and that they attempted to increase the overall effectiveness of the message by combining them appropriately. This is, in our view, an evidence in favour of the hypothesis that the persuasion process cannot be represented with a purely logical formalism but requires to deal with uncertainty of beliefs and strength of goals and arguments. In the following Section, we propose a method to do it.

5 Knowledge Representation

We represent persuasion strategies with belief networks (BNs): these are a well-known formalism to represent probabilistic reasoning in directed acyclic graphs [12] whose nodes represent random (binary or multivalued) variables. The following are some examples of variables denoting statements in the healthy eating domain:

Implies(GoodApp, SaveFace)	Having a good appearance implies saving face
Implies(EatVeg, Health)	Eating vegetables favours good health
Tonifies&Rehydr(Veg, Body)	Vegetables tonify and rehidrate the body
Strenghten(Veg,Muscles&Bones)	Vegetables strengthen muscles and body
Benefit(VitA&C,Skin&Hair)	Vitamins A and C are of benefit to skin and hair
HasBadAspect(Mary)	Mary has a bad aspect
MakesSport(Mary)	Mary makes sport
MakesCheckUp(Mary)	Mary undergoes frequent checkups
LooksAtTVProg(Mary)	Mary looks at TV programs on dieting
V-Goal(Mary, Health)	Being in good health is important to Mary
V-Goal(Mary, GoodMood)	Being in a good mood is important to Mary
A-Goal(Mary, Health)	Being in good health is an active goal in Mary's mind
A-Goal(Mary, GoodApp)	Having a good appearance is an active goal in Mary's mind
CanDo(Mary, EatVeg)	Conditions exist for Mary to eat vegetables
S-Do(Mary, EatVeg)	Mary should have the intention to eat vegetables

Oriented arcs in a belief network represent any kind of relationship among variables. In our case, for instance, if 'Mary undergoes frequent checkups', then one may assume, with a certain degree of uncertainty, that 'Being in good health is important to her'. A probability distribution is assigned to the variables associated with the 'root nodes' of the network (those which have no parents) and a conditional probability table to the other nodes. These parameters assign a numerical weight to the relationships among variables, for every combination of their values.

5.1 Node Types

We introduce a classification of nodes in our BNs which is based on two criteria: aspect of the agent's mental state represented and facts known about the agent:

- *intention-node*: S-Do(agent, action); agent has the intention to do action;
- *valued-goal*: V-goal(agent, goal); goal has a high value to agent;
- *active-goal*: A-goal(agent, goal); goal is active in agent's mind;
- *ability-node*: CanDo(agent, action); external and internal conditions exist for agent to do action;
- *belief-node*: (Bel agent φ_f); agent believes that φ_f;
- *evidence-node*: an agent feature is true.

Some examples of these nodes may be found in Figures 1 to 5: the meaning of node labels in these figures was defined in the table above.

5.2 BN Types

To represent fragments of argumentation/persuasion strategies, we employ 'elementary belief networks' (EBN) classified according to the type of leaf-node. Some examples:

- *'rational' induction of intentions*: this EBN represents the main implication we introduced in Section 3: its leaf node is an intention-node whose parents are a valued-goal, an active-goal, a belief about the means-end relation and an ability-node. An *Argumentation from Consequences* scheme represents the relationship among these nodes (see an example in Fig 1).

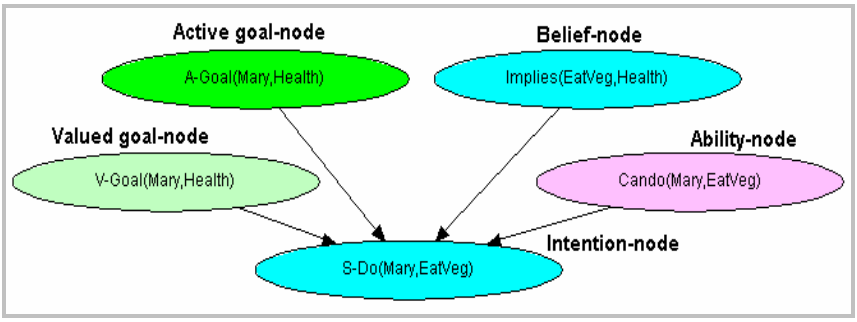


Fig. 1. An intention_EBN in which the goal is 'to be in good health'

- *induction of intentions by appeal to the goal to feel emotions:* this EBN differs from the previous one only in the type of goal, which is *to feel an emotion* ('good mood', in the example in Fig 2).

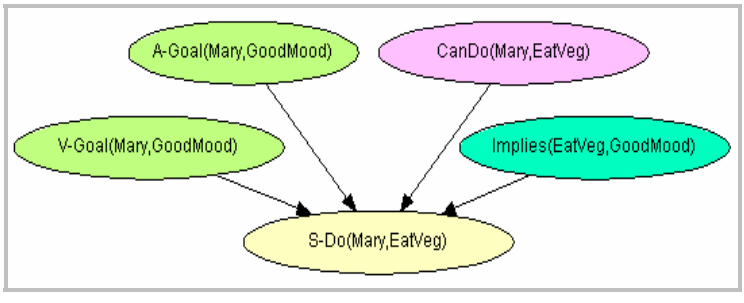


Fig. 2. Another intention_EBN in which the goal is 'too feel in good mood'

- *induction of beliefs:* here, the leaf node is a belief about a means-end implication (eating vegetables and health, in the example in Fig 3), whose parent nodes are belief or evidence nodes in support of this implication. Various argumentation schemes may represent the relationship among these nodes: for example, *Argumentation from Sign* [7].

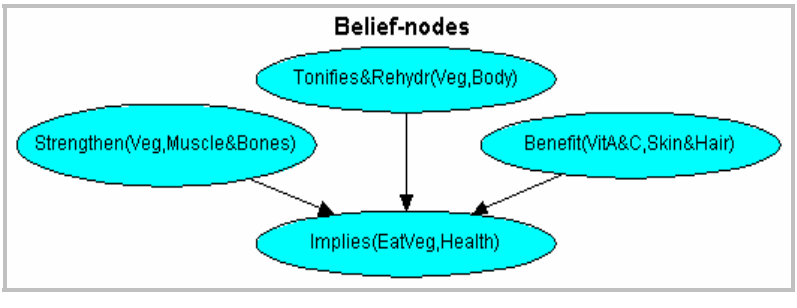


Fig. 3. A *belief-EBN* in which φ_f is 'Eating vegetables favours good health'

- *emotional activation of goals:* the leaf node is, in this case, an A-Goal node. Its roots represent the emotion-activating belief. In the example in Fig 4the topmost root node is 'to have a bad aspect'; this activates the emotion of 'shame' and, consequently the goal of 'saving face'. Another root node represents the relationship between the final goal of 'having a good appearance' and this superordinate goal.

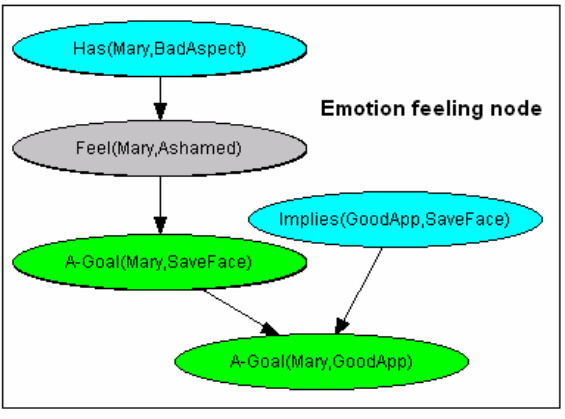


Fig. 4. An *active-goal-EBN* in which the goal is 'to have a good appearance'

- *demonstration of the value of a goal:* here, some evidence in support of the assumption that a given goal is of high value to R is represented (see an example in Fig 5).

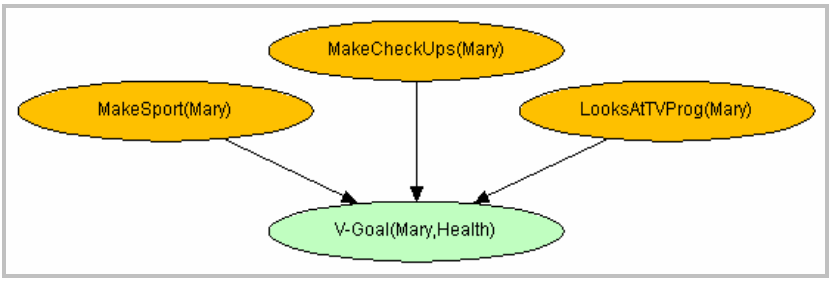


Fig. 5. A *valued-goal-EBN* (same goal as in figure 4)

5.3 Dynamic Construction of BNs

Our BNs are employed to simulate how to plan a persuasion message which is suited to the particular context in which it should be delivered. The BN to employ in a particular context is built starting from an intention-EBN which represents the action the Respondent should be persuaded to perform (for instance, eating vegetables) and a given argumentation scheme (for instance, 'arguing from positive consequences'). This BN may be employed to generate the main part of a monolog or the initial move of a dialog, by applying appropriate natural language generation methods. If, however, the

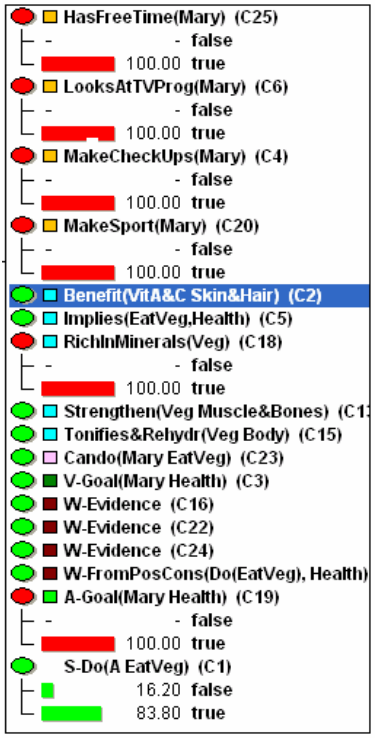
Persuader believes that this elementary message would not be sufficient to persuade the Recipient, other EBNs may be iteratively chained back to it, to strengthen the root-nodes in the network. Chaining back is performed by looking, in the database of EBNs, at the networks which match the node to be strengthened (for instance, a valued-goal node, a CanDo-node, and so on) and at selecting the most appropriate of them in the considered context. The same method may be applied in dialogs to answer 'critical questions' raised by the Recipient.

5.4 An Example

Let us consider again the example text we introduced in Section 3. This text may be represented in a BN which is built by combining an EBN of rational induction of intentions (Fig.1) with other EBNs, of belief induction by means of evidence forwarding (Fig.3) and increase of a goal value (Fig.5). Other combinations may produce texts with more emotional content: for instance, by activating emotionally the goal to be in good health (Fig. 4) or by appealing to the goal to feel an emotion of 'good mood' (Fig.2).

5.5 How to Use the BN

Belief networks are employed to reason on how coming to know some facts or introducing some hypotheses about the value of nodes in the model, changes the probability of the other variables represented in the model. Probabilistic reasoning on the consequences of evidence about some nodes on the rest of the network may be performed by means of a variety of approximation algorithms, all aimed at reducing the inherent time complexity of the problem. In our case, the algorithm applied was due to Spiegelhalter [13].



We employ our models in a 'what-if' mode, to test the persuasion strength of alternative candidate strategies, given some knowledge about the Recipient R. To this aim, we introduce in the BN the available evidence about user characteristics and the beliefs we might hypothetically induce in the Recipient with our message; we observe the effect of propagating this evidence on the probability of the intention-node. If this probability is below a given threshold, we label the strategy as 'fully or partially ineffective', we retract the evidence, and start again the process with an alternative strategy.

This picture shows an example of 'what-if' kind of reasoning. We chain in a BN the EBNs in Fig 1,2,3,5 and set the parameters so as to simulate a high effectiveness of the rational

strategy: the initial probability that Mary will intend to eat vegetables is equal to .36. We now introduce in the network the knowledge items about Mary which are described in the scenario: has free time, looks at TV programs, makes checkups and makes sport and assume that the goal of being in good health is of high value and active in Mary's mind. We then test the effect of telling Mary that 'vegetables are rich in minerals', and propagate all the mentioned evidence in the network: the probability that Mary will intend to eat vegetables becomes .84. Should of the conditions mentioned above do not hold, this strategy would not be so effective: we might enrich it by activating the goal, either rationally or emotionally. Alternatively, we might test a strategy which is focused on the goal to feel emotions or even combine the two strategies, so as to strengthen their individual effect.

6 Conclusions

In this paper we outlined a theory of the possible interaction between emotional and non-emotional persuasion and described how we collected and analyzed a corpus of persuasion texts in the domain of healthy dietary behaviour. With this analysis, we wanted to single out the strategies that were adopted by our subjects in producing a persuasive text. The preliminary results we have got proved that purely rational strategies were employed very infrequently and that emotional elements could be found everywhere, in various forms. Considering probability theory and belief networks as a method for treating uncertainty is not a novelty in the argumentation community. BIAS was the first such system [14]. Gratton [15] proposed to measure the *strength of support* in probabilistic terms. Das [16] measured probabilistically the *confidence* that the inference confers to an argument. Green [17] applied Bayesian Networks to describe arguments in medical genetics. Carofiglio [18] discussed how rational strategies may be formalized with this formalism. In this paper, we demonstrated that this formalism enables, as well, to represent the structure of messages which include various kinds of emotional appeals. The main critique that is advanced to reasoning with belief networks concerns the difficulty of estimating their parameters. To improve the reliability of subjective estimates, sensitivity analysis and learning from datasets may be applied to single out and learn the most critical parameters. A different problem concerns the last step of message generation, in which the results of reasoning must be translated into natural language texts: rendering the variety and subtlety of language styles we found in our corpus of messages is a problem per se, which merits a separate discussion.

References

1. Walton, D.N.: The place of emotion in argument. Philadelphia: The Pennsylvania State University Press (1992)
2. Jorgensen, P. E.: Affect, persuasion and communication processes. In Andersen, P. A. and Guerrero L. K. (eds.): Handbook of Communication and Emotion. Academic Press (1998)
3. Miceli, M., de Rosis, F. and Poggi, I.: Emotional and non emotional persuasion. Applied Artificial Intelligence: an International Journal. In press
4. Toulmin, S.: The Use of Arguments. Cambridge, Ma: Cambridge University Press (1958)

5. Kienpointner, M.: How to Classify Arguments. In van Eermeren, F.H., Grootendorst, R., Blair, J.A. and Willard C.A. (eds.): Argumentation Illuminated (1992) 178-188
6. Walton, D.N.: Nonfallacious Arguments From Ignorance. American Philosophical Quarterly 29 (1991) 381-387
7. Walton, D.N., and Reed, C.A.: Argumentation schemes and defeasible inferences. In Carenini, G., Grasso, F., and Reed, C. (eds.): Working Notes of the ECAI'2002 Workshop on Computational Models of Natural Argument, Lyon (2002)
8. Poggi, I.: The goals of persuasion. Pragmatics and Cognition, 13: 2 (2005) 297-336
9. Lazarus, R.S. 1991. Emotion and adaptation. New York: Oxford University Press.
10. Schwarz, N. 1990. Feelings as information: Informational and motivational functions of affective states. In E.T. Higgins and R.M. Sorrentino (Eds.), Handbook of motivation and cognition: Foundations of social behavior. New York: Guilford Press. Vol. 2, pp. 527-561.
11. Festinger, L.: A theory of cognitive dissonance. Evanston, IL. (1957)
12. Pearl, J.: Probabilistic Reasoning in Expert Systems: Networks of Plausible Reasoning. San Mateo, CA: Morgan Kaufmann (Pubs.) (1988)
13. Spiegelhalter, D.J. 1986. Probabilistic Reasoning in L.N.Kanal and J.F.Lemmer (Eds.), Predictive Expert System, Uncertainty in Artificial Intelligence. North-Holland: Elsevier Science, 4, pp. 357-369.
14. Zukerman, I., Jinah, N., McConachy, R. and George, S.: Recognizing intentions from rejoinders in a bayesian interactive argumentation system. In PRICAI2000 Proceedings, Melbourne, Australia (2000) 241-251
15. Gratton, C.: Counterexamples and degree of support. In Carenini, G., Grasso, F., and Reed, C. (eds.): Proceedings of the Workshop on Computational Models of Natural Arguments, in the scope of ECAI'02 Lyon (2002)
16. Das, S.: Logic of probabilistic arguments. In Carenini, G., Grasso, F., and Reed, C. (eds.): Proceedings of the Workshop on Computational Models of Natural Arguments, in the scope of ECAI'02. Lyon (2002)
17. Green, N.: Towards an empirical model of argumentation in medical genetics. In Carenini, G., Grasso, F., and Reed, C. (eds.): Workshop on Computational Models of Natural Arguments, Acapulco (2003)
18. Carofiglio, V.: Modelling argumentation with belief networks. Workshop on Computational Models of Natural Arguments (CMNA'04), Valencia (2004) 22-24

Well-Being to "Well Done!": The Development Cycle in Role-Playing Games

Pippin Barr[1], Rilla Khaled[1], James Noble[1], and Robert Biddle[2]

[1] Computer Science Department,
Victoria University of Wellington, New Zealand
{pbarr, rkhaled, kjx}@mcs.vuw.ac.nz
[2] Human-Oriented Technology Lab,
Carleton University, Canada
robert_biddle@carleton.ca

Abstract. Interest in designing games to convey persuasive messages concerning human well-being is growing, but presents a number of challenges. A significant problem comes in connecting the *gameplay* with the persuasive intent. We show how the gameplay structure of "avatar development" in popular-role playing games can be applied to the design of persuasive well-being games.

1 Introduction

Interest in computer games as a persuasive technology is on the rise, often with the assumption they allow players to practice skills or attitudes that can then be applied in the real world [1]. Of particular importance is the design of games relating to human well-being, "a healthy, contented, or prosperous condition" [2], from sexual health awareness to broader environmental concerns. A significant challenge in creating such games is understanding how to connect the *gameplay* to the persuasive message of well-being.

Persuasion concerns "an attempt to change attitudes or behaviours or both" [3]. This foregrounding of *behaviour* clearly implicates the *gameplay* as central to any persuasive attempt: the combination of player actions and game reactions through the user-interface. The design of persuasive games must combine the persuasive message and the gameplay.

2 Background

Sales of digital games in the United States have surpassed seven billion dollars for the past two years [4], some online games have thriving economies rivaling those of the real world [5], and certain games have triggered significant moral and legal debate [6]. Digital games are one of the most popular, successful, and *culturally influential* forms of software.

Given this influence, many groups wish to use digital games as a persuasive technology. The recent Serious Games Summit represents a drive toward

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 96–99, 2006.

designing games for more than "just" entertainment [7]. Games designed to promote human well-being, however, often resort to simple operant conditioning approaches such as repetitively associating positive thoughts with mouse clicks [8]. These designs focus heavily on representational content rather than the complex relationship of gameplay and persuasive message.

Games which attempt to combine gameplay and message do exist, but they remain relatively unsophisticated. The *Hubba Hubba Challenge* uses the simple gameplay of making choices in a reactive world to educate teenagers on the importance of using condoms [9]. More complex gameplay structures, such as those of popular games, are an important next step.

3 Well-Being in Role Playing Games

The Role-Playing Game (RPG) genre of computer games is very popular, representing roughly ten percent of units sold in the United States in 2004 [4]. These games involve players taking control of one or more avatars in a virtual world, completing quests, and engaging in combat. The player's relationship with the avatar is central and involves a well-defined development cycle:

1. Taking *action* through the avatar in the world and gaining *resources*
2. Using the resources to directly *upgrade* the avatar
3. Taking *further*, more effective, action through the upgraded avatar

This cycle is the basis of well-being in the game. Upgrading the avatar represents an improvement in well-being which is then *demonstrated* through action. Increases in health and prosperity are measured by detailed statistics. Most importantly, this gameplay structure links the avatar's well-being with *improved action*. A well-developed avatar is better in combat, more likely to survive, and thus to gain further resources for more improvement.

This "development cycle" has value for persuasive games aimed at human well-being. We performed a case study of the RPG *Fable* [10] using multiple methods of data collection, including *analysis-driven play*, *observation* of two typical players, *semi-structured interviews* with those players, and the collection of *official and unofficial documentation*. Based on this study, we suggest some implications for the design of persuasive games in the next section.

4 Implications for Persuasive Well-Being Game Design

In this section we use the example of a hypothetical game, *Quit It!*, designed to encourage players to quit smoking. *Quit It!* includes an avatar representing the player, and uses the avatar development cycle. The avatar can be developed in a number of ways, including appearance as well as statistics relating to fitness, strength, mental toughness, and longevity. The gameplay involves competition in triathlons while quitting smoking. We present five themes drawn from our study of *Fable* along with implications for the design of a game such as *Quit It!*.

4.1 Feeling an Impact

In *Fable* the key to the gameplay is the ability to improve the avatar and then to see this improvement in *action*. When the avatar's strength is increased they are able to wield heavier weapons, making enemies easier to overcome. In order for a development process to be of significance, it must be reflected in the *action* of the gameplay.

In *Quit It!*, the player guides the avatar to stop smoking and to pursue positive actions such as exercise. Through this gameplay the avatar becomes more fit (development) and will be able to perform better in the triathlon (action). Seeing the behaviour related to stopping smoking have an *impact* is the most important message of this structure of gameplay.

4.2 Overcoming Opposition

The success of actions in *Fable* are measured against *opposition*. It is through combat and the completion of quests that players judge their progress or prosperity: Enemies are easier to defeat and quests more straightforward. In addition, threats to well-being are what give meaning to the avatar's health statistic.

In *Quit It!*, the other competitors in the triathlon present a challenge and opportunity to demonstrate prosperity, but they do not threaten the well-being established by quitting. To achieve this we include the threat of cravings for cigarettes or food. These can be combated via gameplay such as clicking on positive thoughts or items that help stave off the cravings to give a sense of immediacy. With progress comes greater ability both in the triathlons and in resisting cravings.

4.3 Quantify and Qualify

Players of *Fable* are able to see their progress by looking at the avatar's statistics. This not only gives their current status, but also indicates the *potential* for development. Qualifiers such as the physical appearance of the avatar and the reactions of others are also important in feeling successful.

In *Quit It!* we can quantify elements of improvement such as fitness, strength, and even longevity. Such quantifications can be based on official statistics relating to smoking and exercise. Players can therefore gain an overview of their progress or status as they continue taking successful action in the game. Other interesting possibilities are improvements such as losing a cough or having a better complexion.

4.4 Escalation

In RPGs such as *Fable*, escalation is an inevitable part of gameplay. As long as the avatar *can* be improved, players will do so. There needs to be increasing challenge or opposition to keep the game balanced. Quests become progressively more difficult, as do the opponents faced in combat.

As the avatar in *Quit It!* grows in health, it can enter more difficult triathlons. The role of *cravings* as opponents can gradually disappear, at which point, the

"game" of quitting may be considered as won. We can allow the player to continue, however, winning further triathlons and reinforcing their achievements.

4.5 Exploits and Experiments

Escalating abilities and challenges can get out of hand. Players often do whatever it takes to get to the highest levels and awareness of this is a part of game design. Players are prepared to *experiment* with the game's capabilities, attempting, for example, to win *Fable* without participating in the system of development at all or doing so only with a limited set of abilities.

In *Quit It!*, we must be aware the players will attempt to "break" the system of gameplay in order to win most efficiently. Additionally, some will try to win every triathlon *without* giving up smoking. One approach is to make such subversion impossible, but perhaps the more interesting possibility is to allow the *difficulty* and health-risk involved in winning triathlons as a heavy smoker to speak for itself.

5 Summary and Future Work

In this paper we have suggested that the traditional "avatar development" structure in RPGs such as *Fable* is a useful model for well-being games. Based on themes from our case study, we have offered a series of design considerations based on the development cycle, using the example of a "quit smoking" game to illustrate their potential application.

References

1. de Aguilera, M., Mendiz, A.: Video games and education: (education in the face of a "parallel school"). Computers in Entertainment **1**(1) (2003) 10–10
2. Brown, L., ed.: The New Shorter Oxford English Dictionary. Volume 2. Oxford University Press (1993)
3. Fogg, B.J.: Persuasive Technology: Using Computers to Change What We Think and Do. Morgan Kaufman Publishers (2003)
4. Entertainment Software Association: Essential facts about the computer and video game industry. Available online at the ESA, `http://www.theesa.com/` (2005)
5. Castronova, E.: On virtual economies. Game Studies **3**(2) (2003) Available online at Game Studies, `http://www.gamestudies.org/0302/castronova/`.
6. BBC News: No more 'hot coffee' sex for GTA. Available online at BBC.co.uk, `http://news.bbc.co.uk/2/hi/technology/4142184.stm` (2005)
7. CMP Game Group: The second annual serious games summit. Website at `http://www.seriousgamessummit.com` (2005) 31 October - 1 November.
8. Baccus, J.R., Baldwin, M.W., , Packer, D.J.: Increasing implicit self-esteem through classical conditioning. Psychological Science **15**(7) (2004) 498–502
9. New Zealand Ministry of Health: No rubba no hubba hubba. `http://www.hubba.co.nz/` (2005)
10. Microsoft Game Studios: Fable. Big Blue Box Studios for X-Box (2004)

Using Computational Agents to Motivate Diet Change

Chris Creed

School of Computer Science, Birmingham University, Birmingham, B15 2TT, UK
cpc@cs.bham.ac.uk
http://www.cs.bham.ac.uk/~cpc/

Abstract. Computational agents which make use of behaviour change models have the potential to help motivate people to change problematic behaviour. The importance of emotion simulation in behaviour change agents is discussed, along with an overview of a behaviour change model (the Transtheoretical Model [1]) that computational agents can make use of. Experiments that will investigate these areas further (within a nutritional domain) are then described.

1 Introduction

Obesity is a major issue in today's world. According to a report published by the National Audit Office in 2001 [2], one in five English adults are clinically obese, with nearly two-thirds of men and over half of women being either overweight or obese. The report (conservatively) estimated that in 1998, obesity was the cause of 30,000 deaths and 18 million absent days from work. Furthermore, the report estimated that the financial cost of obesity treatment to the UK National Health Service (NHS) was around £0.5 billion and possibly £2 billion to the wider economy. These figures seem to represent a world wide trend in the effects of obesity on society. Computers have been used in a variety of ways in an attempt to help people change unhealthy behaviour, but very little research has concentrated on whether autonomous computer agents can help motivate significant behaviour change.

In this paper, we will discuss the importance of incorporating emotion simulation into computational agents which attempt to help motivate people to change their behaviour. An overview of a widely used behaviour change model will then be provided and followed by a description of the experiments that we are planning to conduct over the next few months.

2 Using Emotion Simulation to Motivate and Persuade

Computational agents are often designed with the ability to *express* emotion. These expressions of emotion can be made through a variety of different channels including textual content, speech (synthetic and recorded), and facial expressions. A number of studies have illustrated that we can accurately and reliably

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 100–103, 2006.

identify the emotional expressions of computational agents, but very few have concentrated on the psychological impact that these expressions of emotion have on users. One of the few studies which has concentrated on this was completed by Brave et al. [3], who found that embodied blackjack-playing agents, which were empathetic to the user (through the use of facial expressions and textual content), were rated by subjects to be more likeable, trustworthy and caring than agents which were not empathetic toward the user. However, it is still unknown how *strong* these responses are. In human-human interaction, we are more likely to act on the advice of somebody we like and trust, than someone we dislike and distrust [4]. Does the same principle apply in human-computer interaction (HCI)? If we generally rate emotionally expressive agents as more likeable and trustworthy, can they persuade and motivate people more effectively than unemotional agents?

One related study was conducted by Bickmore and Picard [5], who developed an embodied exercise advisor named Laura, which attempted to help people improve the amount of exercise they did through building a strong working relationship with them over the period of a month. Results showed that while subjects tended to increase their levels of exercise when participating in the experiment, they often went back to their old exercise habits after the experiment.

3 The Transtheoretical Model (TTM)

The TTM [1] is the most widely used behaviour change model and works on the premise that behaviour change involves moving through a number of stages before change is achieved. The stages of the model are precontemplation (when people have no intention of changing their behaviour), contemplation (when people intend to change within the next six months), preparation (when individuals intend to take action within the next month), action (when people have done something to change their behaviour within the past six months) and maintenance (when people have maintained the desired change for at least six months).

The model also defines other constructs including change processes (activities that are used to help progress through the stages), decisional balance (the ability to weigh the pros and cons of changing a behaviour), and self-efficacy (the confidence felt about performing an activity). The model suggests that stage-matching (linking the right process with the right stage) will increase the probability that a person will effectively move through the different stages of change. Linking the wrong process with a stage increases the likelihood that people will relapse into their previous behavioural patterns. The TTM has been applied to a number of different health behaviours (including smoking and eating) and there is evidence to suggest that it is effective across a variety of behaviours (e.g. [6]).

Attempts to automate behaviour change techniques through the use of different media (e.g. desktop computers and mobile devices) with respect to nutrition have had varying degrees of success (e.g. [7]). Future studies need to investigate whether behaviour change models that have been successfully used in human-human interaction, could also be effectively used by autonomous agents.

4 Experiments

The first experiment will take place over the coming weeks and will examine whether a synthetic nutritional coach has the ability to motivate people to eat more healthily. The main hypotheses are: (1) an emotionally expressive coach will be perceived as more likeable, trustworthy and caring than an unemotional coach (2) subjects who interact with an emotional coach will feel more motivated to change their eating habits than subjects who interact with an unemotional coach. We also intend to conduct a similar experiment over an extended period of time where subjects will be asked to have multiple interactions with the coach to examine the long-term effects on peoples' eating behaviour.

4.1 Subjects

A number of studies have found that undergraduates generally tend to have poor diets which are low in fibre and high in fat (e.g. [8]). Therefore, students at the university will be invited to enlist as subjects and randomly assigned to one of two different conditions: emotion and no emotion. In the emotion condition, the agent's voice will range widely in pitch, tempo and loudness and its facial expressions will match the emotion it is expressing. For the no emotion condition, the voice will vary little in pitch, tempo and loudness and the same neutral facial expression will be used throughout the interaction. The dialogue and type of (human) voice used in both conditions will remain the same. Only subjects who are in the contemplation stage of change will be chosen for two reasons: (1) subjects in different stages would require a tailored interaction which could influence results (2) people in this stage are already likely to have some motivation to improve their diet. Assessment of which stage a subject is at will be completed via the use of a questionnaire prior to the experiment starting.

4.2 Procedure

The main processes emphasised in the contemplation stage of change include consciousness raising (increasing awareness), dramatic relief (emotional arousal regarding behaviour), environmental re-evaluation (how the current behaviour affects other people) and self re-evaluation (self reappraisal), with the main goal of the stage to build confidence for change and to achieve a commitment to change. To emphasise these processes, the interaction will follow that of a standard (human) nutritional coach-client interaction (e.g. [9]), with the agent: (1) introducing itself and attempting to build rapport with the subject (2) clarifying both its own and the subject's role (3) enquiring about the subject's diet history and current eating habits (4) discussing the pros and cons of the subject's current diet and in changing their diet (5) discussing different options that the subject has for changing their diet and offering practical tips (6) getting an initial commitment to change from each subject and terminating the interaction effectively. Subjects will be able to respond to the coach's questions by selecting from a list of pre-scripted responses. They will also be informed that they can view educational pages about maintaining a healthy lifestyle for as long as they desire and

that they can return anytime within the next month to look at the educational resources provided. Subjects will then be asked to complete an online questionnaire which will be based on the Working Alliance Inventory (WAI)[10]. Finally, subjects will be debriefed in an attempt to elicit more qualitative information about their perceptions of the interaction.

Subjects' answers to the WAI questions will be used to analyse their perceptions of the agent. Motivation to change eating habits will primarily be measured through four behavioural measures: (1) the amount of time spent viewing the educational content provided (2) the number of educational pages viewed (3) the number of suggested healthy recipes viewed, printed or saved (4) the number of times subjects return to the website to view the resources provided.

5 Conclusion

The experiments proposed in this paper will make an essential contribution to the development of intelligent agents that attempt to help motivate people to change their unhealthy eating habits. Results from each experiment will deepen our understanding of how we respond to emotion simulation and whether computational agents can make effective use of behaviour change models.

References

1. Prochaska, J.O., Norcross, J.C., Diclemente, C.C.: Changing For Good. Avon Books, NewYork (1994)
2. Bourn, J.: Tackling Obesity in England. The Stationery Office, London, UK (2001)
3. Brave, S., Nass, C., Hutchinson, K.: Computers that care: investigating the effects of orientation of emotion exhibited by an embodied computer agent. International Journal of Human-Computer Studies **62** (2005) 161–178
4. Cialdini, R.B.: Influence Science and Practice. Allyn and Bacon, MA, USA (2001)
5. Bickmore, T., Picard, R.: Establishing and maintaining long-term human-computer relationships. ACM Transactions on Computer-Human Interaction (TOCHI) **12** (2005) 293–327
6. Redding, C.A., Rossi, J.S., Rossi, S.R., Velicer, W.F., Prochaska, J.O.: Health behaviour models. The International Electronic Journal of Health Education **3** (2000) 180-193
7. Brug, J., Steenhuis, I., vanAssema, P., deVries, H.: The impact of a computer-tailored nutrition intervention. Preventative Medicine **25** (1996) 236–242
8. Schuette, L.K., Song, W.O., Hoerr, S.L.: Quantitative use of the food guide pyramid to evaluate dietary intake of college students. Journal of the American Dietetic Association **96** (1996) 453–457
9. Hunt, P., Hillsdon, M.: Changing Eating and Exercise Behaviour: A Handbook for Professionals. Blackwell Science, London, UK (1996)
10. Horvath, A., Greenburg, L.: The Working Alliance: Theory, Research and Practice. JohnWiley & Sons, NewYork (1994)

Investigating Social Software as Persuasive Technology

Rilla Khaled[1], Pippin Barr[1], James Noble[1], and Robert Biddle[2]

[1] Victoria University of Wellington,
Wellington, New Zealand
{rkhaled, chikken, kjx}@mcs.vuw.ac.nz
[2] Human Oriented Technology Lab,
Carleton University,
Ottawa, Canada
robert_biddle@carleton.ca

Abstract. Social software (SSW), nowadays increasingly widespread, has excellent potential for use as persuasive technology. What differentiates it from many other persuasive technology platforms is that it is inherently collective, making group dynamics a powerful factor in any SSW context of persuasion. Based on the psychology of groups, persuasion, and cross-cultural theory, we discuss *affiliation*, *access*, and *participation* as themes that are important in understanding SSW's use as a persuasive technology platform.

1 Introduction

Social software (SSW), according to Wikipedia, describes "software that enables people to rendezvous, connect or collaborate through computer-mediated communication and to form online communities" [1]. It is inclusive of Usenet, mailing lists, forums, Yahoo groups, and more recently, blogs, wikis, and social bookmarking applications. Over the last few years, SSW has become mainstream. *Slashdot*, in existence since 1997, and home of the slogan "News for nerds. Stuff that matters", relies on contributors posting articles and links to what *they* find interesting [2]. During the 2004 American presidential campaign, bloggers were the first to publicly question the authenticity of the "Killian Documents" [3]. In July 2005, hours after the first wave of London terrorist attacks, the blog `werenotafraid.com` was launched as a demonstration of citizen unity [4]. Although SSW foremostly describes software that enables the formation of online communities, it can also serve in a powerful, persuasive function, as illustrated by the aforementioned examples. But unlike many existing persuasive technologies, SSW is inherently collective, therefore bringing into effect group dynamics, which have been shown to have a significant effect upon persuasion [5]. In this paper, we seek to clarify the relationship between groups and persuasive strategies from a SSW perspective.

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 104–107, 2006.

2 Social Software and Its Persuasive Potential

SSW brings together people with *any* sort of converging interests, and its content involves constant negotiation between contributors. Arguably it supports customisation of users' tastes more than any other medium. The Elaboration Likehood Model of persuasion shows that if information is personally relevant, people find it more worthy of consideration [6]. SSW therefore has excellent potential as a persuasive technology platform, as its members are already invested in the application's relevance. Unlike many existing persuasive technologies which tend to be designed from a context of individual use, SSW is collective, relying on networks of people collaboratively developing content. Collective problem solving is a common phenomenon in many Eastern, collectivist countries, but also appears in some Western, individualist countries. For example, Alcoholics Anonymous and Weight Watchers are both highly successful organisations that require their members to attend regular support group sessions. These organisations are relying on persuasive mechanisms that naturally operate in group settings, since people are instinctively motivated to behave in particular ways in groups [5]. Already, some SSW applications take advantage of the persuasive potential of group dynamics. The weight loss website *3 Fat Chicks* provides a community blog for its members [7]. In a related, but controversial vein, *Project Shapeshift*, a pro-anorexia forum, encourages members to "support" one another [8]. Clearly SSW has the potential to serve as a powerful persuasive technology, but little research investigates why and how it functions in this capacity.

3 Persuasion Triggers

Social psychology presents us with various ways of analysing the social mechanisms underlying SSW. Referencing persuasion, cross-cultural, and group psychology literature [5, 6, 9, 10, 11, 12, 13], we discuss some aspects of group identity, interaction, and motivation, that we believe affect persuasion in group contexts. Our discussion is divided into the themes of *affiliation*, *access*, and *participation*.

Affiliation. An interesting feature of SSW communities is that their members join voluntarily. The cross-cultural psychologist, Masaki Yuki, argues that when this style of community formation occurs in the offline world amongst Western participants, they take pride in the characteristics of the group, relative to other groups [9]. These characteristics then contribute to feelings of affiliation, that can enhance motivation to carry out actions [10]. Affiliation in this context plays a similar role to relevance, in that people who affiliate to a community are likely to be engaged with the thoughts and actions of other community members. Enhancing affiliation to a SSW community may therefore enhance people's willingness to be persuaded by the SSW community's goals.

Access. SSW communities generally allow members to access each other's contributions, whether these take the form of ideas, opinions, or perhaps experiences. For people to find value in the contributions of others, however, they need not

actively participate in contribution themselves, but they probably do need to feel at least a low level of affiliation in order for the contributions to seem meaningful, relevant, and useful [14]. Being able to access opinions and experiences of others enables *social comparison*, where people are interested in comparing other people's experiences with their own [11]. But in order to perform the comparison, people need to perform the behaviour themselves, which is where persuasion takes place. This access also facilitates *social learning*, where people learn and are persuaded by the experiences of others performing particular behaviours [12]. Recent thinking also points to crowds being very good at discerning optimum choices or solutions from pools of possibilities [15]. Therefore *crowd wisdom*, an almost inevitable outcome of SSW communities, is another persuasive advantage that access to diverse opinions and experience enables. In contrast to the diversity of group opinions is *normative influence*, when group-established norms, whether they be attitudinal or behavioural, become so internalised by individual members that they continue upholding them independently of the group's presence [5]. So if a SSW community is founded upon its members sharing various common motivations, then individual members might come to rely on the group's beliefs as a whole as motivation.

Participation. Active participation in SSW communities elicits a variety of other motivators that impact upon persuasion. Many of these are related to members' feelings of concern about upholding group identity and maintaining group harmony. One of these is *social approval*, where people are persuaded to behave in particular ways to obtain the approval of others [5]. In a SSW context, contributors might perform behaviours to obtain respect, encouragement, and/or feedback from other members. *Group reputation* is another powerful motivator relating to identity: people are often persuaded to act in particular ways to either maintain or increase the reputation of their group [13]. Therefore a SSW contributor who knows her group identifies itself on the basis of *not* performing certain behaviours will also feel persuaded to not perform those behaviours herself, in order to uphold the group's reputation. Related to group reputation is *inter-group comparison*, where group members will compare their own group against others, and experience feelings of competition with members of other groups [9]. Inter-group comparison can therefore function as a persuasive motivator to mobilise SSW community members to perform behaviours that constitute competing against other SSW communities. An integral part of SSW philosophy is the idea of collective content development [1], or *co-operation*. Co-operation reduces the burden upon single group members, while culminating in more progress than could have been achieved by an individual [15]. Remembering the larger pay-off that results as a consequence of small input can serve as motivation for people to perform behaviours. An associated notion is *self-regulation*, commonplace practice in many SSW communities, describing situations where community members do their own "policing". Members may feel motivated to behave in certain ways so as to uphold group standards, but equally, since they themselves "police" the community, group standards may become internalised for reasons of consistency. Self-regulation also brings into effect *reciprocity*, where

people feel compelled to pay back favours others have done for them [10]. In a SSW community, if a member feels other members have supported her, she may feel persuaded to behave in ways that will support those who have supported her, or more generally, the community at large.

4 Conclusions and Future Research

Social software has characteristics that make it suitable for use as a persuasive technology platform: it can cater to any interest, its content can be rapidly modified, and its members engage with its content. Unlike many other persuasive technologies, it is collective, therefore calling into effect group dynamics that impact upon persuasion. Based on these characteristics, we have identified three themes of SSW persuasion. *Affiliation* looks at how community identification increases motivation, while *access* focuses on how the beliefs and opinions of other members serve in a persuasive role even to non-contributors. Finally, *participation* relates to how contributing members are persuaded to act in particular ways to uphold group identity and maintain group harmony. Focusing on these themes and their underlying motivations during the design process of SSW may improve the likelihood of intentional persuasion. Future steps for this research include identifying the best ways to maximise the persuasive "pay-offs" of the aforementioned motivations in the design of SSW, and measuring the persuasion effects of motivation-designed SSW against that of regular SSW.

References

1. `http://en.wikipedia.org/wiki/Social_software`: Social software (2005)
2. `http://slashdot.org/`: Slashdot: News for nerds, stuff that matters (2005)
3. Quinton, J.: Backcountry Conservative. `http://www.jquinton.com/archives/001732.html` (2004)
4. `http://www.werenotafraid.com/`: We're not afraid (2005)
5. Kitayama, S., Burnstein, E.: Social Influences, Persuasion, and Group Decision Making. In Brock, T.C., ed.: Persuasion: Psychological Insights and Perspectives. Allyn and Beacon (1994) 175 – 194
6. Petty, R., Cacippo, J.: Communication and Persuasion: Central and Peripheral Routes to Attitude Change. Springer-Verlag (1986)
7. `http://www.3fatchicks.com/journals/index.php`: 3 Fat Chicks on a Diet (2005)
8. `http://www.plagueangel.net/psboard/`: Project ShapeShift (2005)
9. Yuki, M.: Intergroup comparison versus intragroup relationships. Social Psychology Quarterly **66** (2003) 166 – 183
10. Cialdini, R.B.: Interpersonal influence. In Brock, T.C., ed.: Persuasion: Psychological Insights and Perspectives. Allyn and Beacon (1994) 195 – 217
11. Festinger, L.: A theory of social comparison. Human Relations **7** (1954) 117 – 140
12. Bandura, A.: Social Learning Theory. General Learning Press (1977)
13. Triandis, H.: Individualism and Collectivism. Westview Press (1995)
14. Nonnecke, B., Preece, J.: Lurker demographics: counting the silent. In: Proceedings of the SIGCHI conference on Human factors in computing systems. (2000) 73–80
15. Surowiecki, J.: The Wisdom of Crowds. Doubleday (2004)

Towards an Architecture for an Adaptive Persuasive System

Hien Nguyen and Judith Masthoff

Computing Science Department, University of Aberdeen
{hnguyen, jmasthof}@csd.abdn.ac.uk

Abstract. Marketing is essential to the survival of any product. Marketing a product is persuading people that the product can benefit them and meet their needs. Due to the diversity among people, a successful marketing strategy needs to adapt to individuals. Moreover, for certain products such as houses, the final decision tends to involve a group of people rather than an individual. In this paper, we propose an architecture for a system that produces an interactive video, which can adapt to a user or a group of users to promote a new product.

1 Introduction

According to consumer behaviour theory, lifestyle is the motivation for buying [1] and this has been applied heavily in marketing. Salespeople often present a product in a different way to each customer to maximise the chance of selling it. The need for utilising lifestyle has also been acknowledged for adaptive hypermedia [2], but very few systems have addressed this.

In contrast to recommender systems that try to find a product that suits the user, we are investigating how to sell *one specific product* to a user or a group of users (e.g. a course or a house). So, we will deal with the user(s) a limited number of times, and are unlikely to know their opinions on similar products. However, we can find out which features of our product were liked or disliked by previous users (who may or may not have bought our product). This can be used to predict the opinions of a new user based on their similarities with the previous users. Hence, we propose a solution that combines a lifestyle-based approach and collaborative filtering to anticipate which product features should be presented to the user. The system promotes a product by showing the user(s) an interactive and personalised video.

2 Architecture

As discussed in [2], the adaptation process consists of 3 stages: acquiring information about the user, processing the acquired information to build or update the user model, and finally using the user model to provide the adaptation. Our proposed architecture, shown in Figure 1, follows this 3-stage model. Each component of the architecture will be explained in detail in the following sections.

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 108 – 111, 2006.

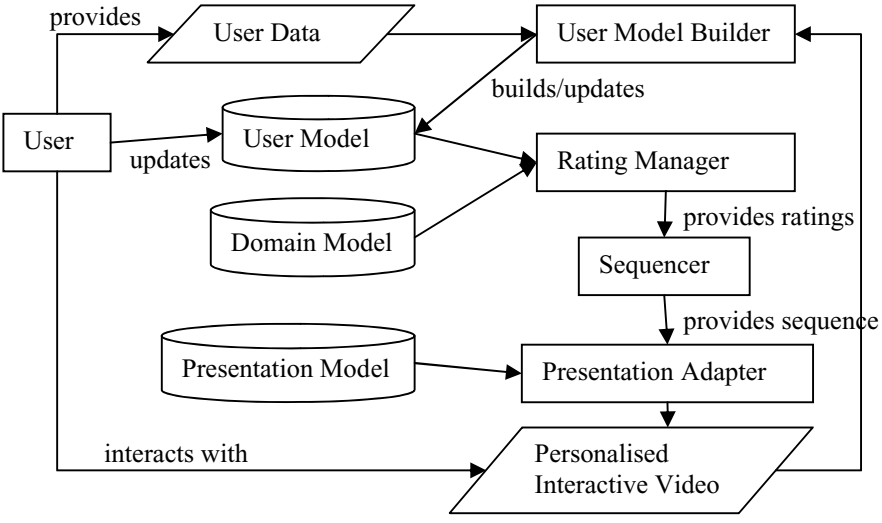


Fig. 1. System architecture

2.1 The User Model Builder and User Model

The User Model Builder handles the first and second stage of our adaptation process. It processes data provided by the user to build the User Model of our system. It collects data about the user by asking him/her to answer an "adaptive" questionnaire when they use the system for the first time. The questionnaire mainly consists of questions about the user's background and lifestyle. Adaptive techniques used in hypertext systems can be applied in the process of administrating the questionnaire. For example, if a user is single and young, then the system will not ask if he or she has any children. These adaptations will be partly based on stereotypes. The questionnaire will take the form of a conversation, rather than a form to fill out. Once the initial User Model has been built, it can be updated explicitly by the user or implicitly by the User Model Builder based on observations of the user's interaction with the system.

2.2 The Domain Model

The Domain Model holds both positive and negative facts about the product that we sell. Each fact describes a feature of the product and a possible benefit or drawback to the user, and carries a weight (1 = small impact to 5 = large impact) to express the size of the benefit or drawback. If a fact is negative, we also add in a counterargument to overcome the disadvantage. For example, if we sell a house, we might have two positive facts about the garage and one positive and two negative facts about a nightclub nearby as shown in the tables below. The weight of the garage providing a parking space depends on how difficult parking tends to be in that area; the weight of the nightclub's noise depends on how close the nightclub is and how loud the music.

Feature	Benefit	User characteristic	Weight
Garage	No worry about a parking space	Has a car	5
Garage	Can be turned into a playroom	Has young children	2
Nightclub	Entertainment on your doorstep	Likes going out	4

Feature	Drawback	Counterargument	User characteristic	Weight
Nightclub	Noise	Double glazing	Has young children	4
Nightclub	Possible violence	Never noticed	Any user	2

2.3 The Rating Manager

Unlike other adaptive systems, which collect users' opinions about a product by asking them to rate similar products, our system will predict how important each product feature is for influencing the user's opinion. This function is carried out by the Rating Manager, which first rates each fact in the Domain Model with respect to the user. It then calculates a rating for each feature by combining the ratings of its facts. The Rating Manager can rate a fact in two ways. The first approach is based on the User Model providing a likelihood of the user having the characteristics that make this fact important (like having a car). The second approach applies Collaborative filtering in which the user's predicted rating of a fact is based on the rating of that fact by previous users that are similar to the user. We will use a hybrid of these two. The end results might look as follows, for two users who are buying a house together:

	Garage	Bedroom	Lounge	Kitchen	Garden	Nightclub
John	10	4	3	9	6	10
Adam	1	9	8	9	6	3

2.4 The Sequencer

Given the ratings, the Sequencer first decides which features will be brought to the attention of the user. Clearly, showing features that the user dislikes will not increase our chance of selling the product. However, sometimes even negative features will need to be presented. For instance, when presenting a house, you cannot simply skip the kitchen. When selling to a group of users, ratings of individuals will need to be aggregated into a group model. For this, we will use the strategies proposed in [3], but with different weights for different users (e.g. children getting less weight). Additionally, time-constraints and avoiding information overloading for the user should be considered.

Secondly, it decides in which order to present the chosen features. The order can affect the user's mood and opinion, due to emotions wearing-off over time and assimilation effects (i.e. the user's mood impacts their reaction to new facts) [4]. So, it is not best to present features simply in the order of rating. Excellent features may need to be interleaved with less good features. A logical domain order should also be considered (e.g., discussing adjacent rooms in sequence). Finally, it uses a similar process to decide for each chosen feature which facts to present and in which order.

2.5 The Presentation Model and Presentation Builder

Given a sequence of facts to present, the Presentation Builder will have to decide which presentation form of each fact best suits the user, informed by the Presentation Model which holds at least one presentation form for each fact (e.g. text, video). A number of factors should be considered including the user's abilities, time-constraints, allocating a shorter time for low rating items, network bandwidth, etc.

The Presentation Builder also shows the user positive and negative opinions of previous users. Positive reviews are added because of research on social conformity (e.g. [5]). Users have been shown to change their opinion if considerably many other users disagree with them, and they are more convinced if considerably many other users agree with them. Negative reviews are added to make the presentation more trustworthy, as no product can please every customer in reality. However, the Presentation Builder only selects negative reviews that are of little importance to the user given his/her User Model and Domain Model (e.g. complaints about lack of parking if the user does not own a car). The final result is an interactive video that can be broadcasted to the users over the internet or digital TV.

3 Conclusions

We have presented an architecture for a persuasive adaptive system that can market a particular product, to an individual user or a group of users. This work is in its initial stages, and precise algorithms will need to be developed for each module discussed in the architecture, inspired by the ideas presented in this paper. A prototype system will be developed for student recruitment for our department, to sell our degrees. Evaluation of the prototype system will be carried out using empirical methods. We will also extend existing research on group modeling and satisfaction prediction, and investigate new adaptive techniques and user-interface patterns for time-based media.

References

1. Hawkins, I., Best, R.J., & Coney, K.A. (1998). *Consumer behaviour: Building a marketing strategy*. New York: Irwin/McGraw-Hill.
2. Brusilovsky, P. (2001). Methods and techniques of adaptive hypermedia. *User Modelling and User Adapted Interaction*, 6, 87-129.
3. Masthoff, J. (2004). Group Modelling: Selecting a Sequence of Television Items. *User Modelling and User Adapted Interaction*, *14*, 37-85.
4. Wilson, T.D., Gilbert, D.T. (2003). Affective forecasting. *Advances in Experimental Social Psychology, 35,* 345-411.
5. Asch, S. (1951). Effects of group pressure on the modification and distortion of judgements. In H. Guetzkow (Ed.), Groups, leadership and men. Pittsburgh: Carnegie Press. 177-190.

Persuasive Design: Fringes and Foundations

Johan Redström

Design Studio, Interactive Institute and Center for Design Research,
Royal Academy of Fine Arts, School of Architecture,
Philip de Langes Allé, 1435 Copenhagen, Denmark
Johan.Redstrom@karch.dk

Abstract. To understand what it means to design 'persuasive technology', one probably needs to understand it in relation to design in general. Using examples from a variety of areas of design discourse, the first part of the paper presents the idea that design is inherently persuasive. Following a discussion of what this might imply to the identification of 'persuasive design' as an emerging research area, the idea of objects as persuasive arguments in material form is presented. Suggesting that this notion could be used as basis for working with persuasion in design, the paper finally presents a practical example of how this might work in a design research project.

1 Introduction

As a new research area emerges it faces a certain challenge: on one hand it needs to build on what is already there; on the other, it needs to differentiate itself from its surroundings as to motivate its existence. And so, to understand the conditions for growing a new research area like persuasive technology, we need not only look at the core issues around which it will be formed, but also at its fringes where it connects and disconnects to what surrounds it. As others have provided excellent presentations of the core issues (cf. [9]), the focus of this paper will be certain parts of the outskirts.

In what follows, I will present some thoughts on 'persuasive design'. The ambition is not to properly define 'persuasive design' as a research area, nor to present an overview of what it may entail or what canonical examples might be like. Rather, the purpose is to discuss some problems and possibilities pertaining to how it relates to a more general design discourse.

2 Inherently Persuasive Design

A significant challenge in describing and eventually also defining 'persuasive technology', is that technology in general not only can, but perhaps *needs* to be understood as inherently persuasive, and that technology design as such always is about persuasion in one way or another. If this argument is right, it means that 'persuasive technology' as a concept defining a new area is somewhat problematic.

In everyday life, there is a range of everyday situations where we understand that design influences the way we think, often with respect to commercial incitements. It

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 112 – 122, 2006.

seems, things and environments can be designed to persuade us to, for instance, buy something we at first did not know we needed. What is perhaps not that clear, however, is that design shapes the way we think and live also in other and sometimes fundamental ways.

A useful starting point for this investigation is the work of the American design theorist Buchanan on how design can be understood as rhetoric:

> In this sense, rhetoric is an art of shaping society, changing the course of individuals and communities, and setting patterns for new actions. However, with the rise of technology in the twentieth century, the remarkable power of man-made objects to accomplish something very similar has been discovered. By presenting an audience of potential users with a new product – whether simple as a plow or a new form of hybrid corn, or as complex as an electric light bulb or a computer – designers have directly influenced the actions of individuals and communities, changed attitudes and values, and shaped society in surprisingly fundamental ways. This is an avenue of persuasion not previously recognized [3, p. 93]

At least in this part of the world, we live in a more or less man-made environment where even the layout of the ground as well as its landmarks have been designed to some extent. In all these environments and objects, there are prescribed ways of using them that will influence and govern the way we work, live and think. Though the idea that technology needs to be understood as a cultural phenomenon, and that there are strong relations between technology, materiality and society are not in themselves new, there is an increasing interest in what these relations actually look like (cf. [4,12]). Buchanan again:

> The point, however, is not simply that technology is distinct from science. More important, it is that technology is fundamentally concerned with a form of persuasion and, as with traditional rhetoric, speaks from no special authority about the good life. It provides only resources that are used to support a variety of arguments about practical living, reflecting different ideas and viewpoints on social life. ... Design is an art of thought directed to practical action through the persuasiveness of objects and, therefore, design involves the vivid expression of competing ideas about social life. [3, p. 94]

> This article suggests that the designer, instead of simply making an object or a thing, is actually creating a persuasive argument that comes to life whenever a user considers or uses a product as a means to some end. [3, p. 95f]

Thus, Buchanan presents an explicit argument that technology design is about persuasion, and that it can be analysed in rhetoric terms. There are, however, related views also in other fields of enquiry. Let us compare Buchanan's argument with Akrich's sociological perspective on the design of technical objects:

> For some time sociologists of technology have argued that when technologists define the characteristics of their objects, they necessarily make hypothesis about the entities that make up the world into which the object is to be inserted. Designers thus define actors with specific tastes, competences, motives, aspirations, political prejudices, and the rest, … A large part of the work of innovators is that of *"inscribing"* this vision of (or prediction about) the world in the technical content of the new object. [1, p. 207]

Buchanan's and Akrich's remarks suggest that design activity directly deals with issues of persuasion, in the sense that the technical object carries with it certain ideas about its use and context. That these "persuasive arguments" and "inscribed visions" at least to some extent translate into the user's experience of the design can be seen in critical perspectives on technology design. For instance, Marcuse once made the following remark:

> The means of mass transportation and communication, the commodities of lodging, food, and clothing, the irresistible output of the entertainment and information industry carry with them prescribed attitudes and habits, certain intellectual and emotional reactions which bind the consumers more or less pleasantly to the producers and, through the latter, to the whole. The products indoctrinate and manipulate [16, p. 14]

This critique is quite present also within design – thus not only being about the perspective of an external observer. One example can be found in the work of Dunne:

> This enslavement is not, strictly speaking, to machines, nor to the people who build and own them, but to the conceptual models, values, and systems of thought the machines embody. User-friendliness helps to naturalise electronic objects and the values they embody. For example, while using electronic objects the use is constrained by the simple generalised model of a user these objects are designed around: the more time we spend using them the more time we spend as a caricature. [5, p. 30]

On a more general level, the question of whether technology, in principle, can be neutral or not, has been analysed in the philosophy of technology. Especially from Heidegger onwards, relations between the tool and its user, between technologies and ways of thinking and living, have been explored (e.g. [2, 12, 13]). A re-occurring idea in this work is that just as the user uses an object, so does the object use its user.

> The question is never so much a matter of controlling technologies, since even the simplest technology (such as dip ink pen) has an ombra of counter control on the user. I am used as much as I use any technology, whether on a first person or a social level. [12, p. 116f]

Combining the perspectives exemplified above, it seems that there are rather strong reasons for assuming that ideas about use and users do translate into the designed thing in ways that can be seen as rather similar to what persuasion is about. Paraphrasing Fogg [9], one might be tempted to say that technology *always* change what we think and do.

An observation, that follows through all the examples presented above, is that design is normative: a given thing could always have been designed differently. The man-made deals with the contingent. As designs are normative, about setting norms, they do not only present and represent a certain point of view that can be contested, they also act as a kind of arguments in favour for adopting that particular point of view. But does this in itself make design into a matter of persuasion? One might object that we deal with a somewhat diluted notion of persuasion here, as seemingly all design will influence the way people act and think.

Consider an example from Fogg's seminal paper on persuasion and computers, where he illustrates that not all changes in behaviour and attitude can be understood in terms of persuasion as some of them lack a designer's intention to persuade: "a rain

storm may cause people to buy umbrellas, but the storm is not a persuasive event because it has no intentionality associated with it. (However, if an umbrella manufacturer could somehow cause rain, then the rain storm might qualify as a persuasive tactic.)" [8, p 226]. But what about the umbrellas themselves? If Buchanan [3] is right, they need to be understood as persuasive artefacts as they do bring about a change in our behaviour, and possibly also in our attitudes, in relation to the rain. Further, though the designers of the umbrella probably did not think about their design in terms of 'persuasion', the resulting change in user behaviour, and possibly also attitude towards being outdoors when it is raining, is certainly intentional.

Just as the designer makes certain decisions, so does the user; there is always a choice between accepting and disregarding the proposed way of doing things. The fact that a given design represents a certain perspective on the issues dealt with, does, of course, not imply that the user is bound to think the same way. Thus, there is a certain *dialogue* going on: the designer proposes certain things through the designed thing, and the user then accepts, refutes, or modifies these in relation to her own position. In practice, results of such a dialogue can, for instance, be seen in the often unpredictable discrepancies between intended and actual use (cf. [19]). But this does not, in itself, determine whether this is about persuasion or not; just as any other means of persuasion can succeed or fail, so can a persuasive argument carried by a design.

Whether we accept the idea that design is inherently about persuasion or not, at least we learn that identifying any clear borders around 'persuasive design' is far from trivial. In terms of 'argumentation' much design is quite remote from what we might think of as 'persuasive arguments', but if we turn to the effect that designed objects have on people, their attitudes and actions, it is clear that we are dealing with quite powerful means for influencing people. Clearly, the notion of persuasion in design touches fundamental aspects of what design is about.

3 Developing 'Persuasive Design'

How, then, can we qualify the term 'persuasive design' and make it meaningful as a concept describing a 'new' research area? Let me briefly suggest a few options.

One way to make the notion of persuasive design more precise in relation to the more general design discourse discussed above would be to define the term in a more technical way, much like the term usability is now used in the usability literature. This is a strategy for focusing our attention and effort towards a limited set of issues, of course realizing that much of what is included in our everyday use of the term would have to be left out, just as much related to the use of things is left outside of for instance the ISO definition of usability [14]. Around such a technical notion of persuasion we would then be able to cluster analytic tools, design methods, evaluation techniques, etc. which, hopefully, would enable us to achieve a certain predictability of outcomes.

Another way would be to think about persuasive design as we have come to think of user-centred design. Obviously, all design involves users at some point (unless it never becomes used at all, that is), but with user-centred design, we place concerns related to user participation, satisfaction, etc., at the centre of the process. Persuasive design interpreted this way would then be able to deal with many kinds of design,

much like user-centred design methods can be applied in many areas. Very likely, this would eventually define the area in terms of a set of methods and approaches rather than as a specific kind of design, much like user-centred design is easier to understand in terms of characteristic processes than in terms of certain outcomes.

A third strategy, at least at the moment advocated by the author, would be to think of persuasive design as centred on the notion of argumentation as embedded in, and embodied by, artefacts, and the *dialogue* between designer and user regarding use that follows from this. It recognizes that persuasion is not something designers necessarily choose to do, but simply do, and that it therefore is something we need to acknowledge, explore and understand as we design things.

This notion of 'persuasive design' points to a basic aspect of how design, use and object are related. Therefore, it can not be restricted to the objectives of persuasion, i.e. about finding out the means for persuading a given audience to think in a certain way, as it needs to deal with persuasion not only as communication of designer intent, but as a way of relating to artefacts. Of course, persuasive design in this sense can be about the design of information systems and online services, but it is perhaps in the increasing interest in issues of embodiment, materiality, and forms of interaction where physical and material aspects are central, that we more clearly see the close relation to the studies and critique of technology discussed above (cf. [18]).

In the following section, I will try to develop these ideas of embodied arguments and object-user dialogues a bit further as to illustrate how they can be seen as a basis for working with persuasion in design.

4 Arguments in Material Form

Implicit in the discussion above is the idea that the means and modes of persuasion involved here do not work like more traditional communication processes, where we might expect to find explicit and preferably verbalized arguments. Rather, it seems that things influence the way we think and act simply through their physical form, i.e. that the 'persuasive argument' seem to be able to exist in material form.

Since this may sound a bit strange, let us consider a few examples. One illustration could be ergonomic design and how such design can be used to influence people's behaviours. A beautiful example of how to make someone sit in a certain fashion is Aalto's *Paimio* armchair No. 41. Designed for patients with tuberculosis, its back has been designed to promote a posture that eases breathing. Another example is the *Balans* chair by Opsvik and Menghshoel for Stokke, where you partly sit on your knees to achieve a very upright and ergonomically beneficial posture. Both these chairs suggest a certain way of sitting and they do so for a specific medical purpose – and when you sit down in them, it is hard not to accept the suggestion.

Though not explicitly dealing with the notion of persuasion, there are a several theories about how physical objects may influence the actions and attitudes of their users. For instance, we find such ideas in product semantics where the process of making sense of products in often linguistic terms is studied (e.g.[15]). If one is more familiar with the cognitivist line of enquiry, one might think of notions such as situated or embodied cognition (e.g.[17]). Or consider the term 'affordance' as introduced by Gibson [10]. Though Gibson's main concern was how to understand

how the living animal makes sense of her environment in meaningful ways, various interpretations of the concept have become widely used in especially technology-related design to describe features of an object that, in various ways and senses, 'inform' the user about what can be done and how.

To generalise, there are several ways of describing how an object can 'invite' its user to given courses of action just by the way it presents itself to us. However, just as we normally do not refer to all things in the world as being 'designed', so does the idea that objects lend themselves to certain actions not in itself make this into a matter of persuasion. But here we need to consider the role of designer intent, the role of that *someone* who designed the thing – is it not a different story when we use 'affordances' to describe design intentions, i.e. when we explicitly aim to form the object in a way that will invite to certain courses of action (cf. Fogg on intention as a characterising feature of persuasion [8])?

Another place to look for examples of how arguments can be embodied in material objects, is design where the aforementioned dialogue between user and object regarding use is intentionally exposed. To continue the rhetoric metaphor, we might look for examples of 'rhetorical questions' in design, or examples where there is a slight but still clear shift from design as providing a definite answer about what to do, to design as posing questions about use and context.

Let us consider an example from a designer here in Eindhoven: Poll's chair *Do Hit* produced by Droog Design comes as an unfinished piece that you have to shape yourself using a sledgehammer. Is this an example of a designer not trying to persuade the user about a certain way of 'sitting' like the Aalto and Stokke chairs discussed above seem to, or is it indeed a way of enforcing an argument using a rhetorical question? Whatever the answer, the Do Hit chair creates a rather complex relation between design and use through its involvement of the user in the process of forming the object. Hunt comments:

> To explore formlessness of design is not necessarily to forgo form altogether, which would be impossible. … What distinguishes this approach is the abandonment of form as the first principle of design success. Instead, designers are venturing into the muddier regions of design's impact on our social life. They are exploring alternative ways of using the process to address social, emotional, and political ends. Again, the transformation of the social environment – not just the built environment – emerges as the focal point of the project. [11 p. 69]

Continuing our discussion of chairs, the *Faraday Chair* by Dunne is an example where a departure from the expected is used as a way of exposing certain questions, in this case about what it means to live in an environment saturated by electromagnetic radiation.

> A FARADAY CHAIR could provide a new image of the technological person: not of a cyborg fusing with technology, or of a master of technology, but of vulnerability and uncertainty about the long-term effects of the technologies now so enthusiastically embraced. … Although the final object was a smaller version of a day bed, requiring the occupant to adopt a foetal position, I kept the title FARADAY CHAIR to suggest that, once electromagnetic fields are taken into consideration, conventional assumptions about everyday objects need to be re-examined. [5, p. 104f]

Being a Faraday cage that looks more like an aquarium in which you will barely fit than anything resembling a traditional chair, the Faraday Chair embodies a different meaning of what it means to sit down and have a rest. Just because it is so far from a traditional chair, it can not easily be accepted as just an alternative design solution. Instead, this tension creates a space for critical reflection upon how we relate to electronic objects – and to chairs for that matter.

Neither Do Hit nor the Faraday Chair are typical examples of what we might think of as 'persuasive designs'. In fact, they are quite far from anything we would expect to find in the emerging literature on the subject. Their relevance as examples of how to approach issues of persuasion in design, however, becomes even more apparent as we think of, for instance, objectives such as how to initiate changes in user behaviour and attitude. In some ways related to the idea of technology 'breakdown' as a way of opening up new design opportunities by revealing something we can not see when things are working like normal (cf. [20]), they present examples of how to create resistance in use, something that make us to stop for a moment and reflect upon our habits and relations to the familiar we no longer see but simply take for granted. In relation to such issues, work on how to open up a space for critical reflection might well be quite important to the development of persuasive design, perhaps even more so as it explicitly deals with issues of how rather complex questions and arguments can be expressed in and through physical objects.

Presumably, none of the four chairs discussed above were originally conceived as 'persuasive arguments' or 'persuasive designs'. More likely, they were just 'designed', be it with certain ideas about use and user. And yet, a persuasive dimension of design is clearly present here. Again, these rather intriguing examples of what we might think of as 'persuasive design' remind us that this is a far from trivial subject.

5 A Practical Example

As an illustration that the perspective on persuasion in design sketched above is not just a theoretical construct, but potentially also a viable starting point for actual design projects, I will describe some of our own work that were inspired by these ideas. In a project called *Static!* funded by the Swedish Energy Agency, we have explored ways in which experimental interaction design can be used to promote awareness of, and stimulate changes in, energy consumption. The basic idea was to look for complements to existing strategies such as information campaigns and more energy-efficient technologies, and instead explore how the ways we interact with objects could be reinterpreted and transformed as to create a different and possibly also more subtle and tangible relation to energy in everyday life.

The Static! project was structured as a series of case studies, or sub-projects, each exploring different use contexts, design materials, object categories and/or design approaches. The ambition was to develop a palette of examples of how energy could be made more present in and through design that could act as a basis for further development and study. In the following, I will describe two such examples – the *Energy Curtain* and the *Erratic Radio*.

5.1 The Energy Curtain

The Energy Curtain was developed at the intersection between Static! and another project that explored how emerging technologies might be combined with traditional design materials, in this case information technology and textiles [6]. Thus, the aesthetics of textile materials in combination with electronics was a central issue, as were questions about how the use of electronic objects depends on continuous access to electrical power.

The Energy Curtain is based on a reinterpretation and transformation of what it means to use a curtain to control light. Typically, a curtain is moved (e.g. rolled down) to create the shade and then moved away (e.g. pulled up) when we instead want to enjoy the sunlight. This 'new' curtain adds another layer to this interaction. The side facing outwards is covered with solar panels that collect energy whenever the sun is shining. The side facing the room is made from a material where fibre optics have been woven into the fabric. Batteries charged by the solar panels power a series of diodes that light up the optic fibres and as the fibres have been sanded, their surface will emit light thus making the curtain light up in the dark.

Using this Energy Curtain implies that there is a direct trade-off between enjoying the sunlight now, or saving the energy to be able to enjoy its light later when it gets dark. Thus, the way we interact with it forces us to make an explicit choice – and since the curtain is self-sufficient and not connected to any power network it also becomes clear that we can not have it both ways. Using this curtain therefore becomes a tangible exercise in the art of finding a balance between consuming and conserving energy.

5.2 The Erratic Radio

Whereas the Energy Curtain focused on the interaction with a single object, the development of the Erratic Radio aimed at exploring also the context of objects in use [7]. Using the kitchen as a starting point, we developed a series of conceptual sketches of how the behaviour of household appliances could be made to reflect aspects of overall energy consumption and how our energy use accumulates through the interactions with multiple objects.

The notion of erratic appliances partly came as a response to an idea of expressing the indeterminacy and uncertainty that might follow from over-consumption and uncontrolled increase in use of natural resources. These appliances are erratic in the sense that they start to behave strangely as energy use increases in their vicinity. Thus, to keep them working properly, one needs to keep the balance, e.g., by switching something off as another appliance is to be turned on. In this way, we aimed at making the consequences of one's actions happen "here and now" instead of something that might happen long after and most likely somewhere else.

The Erratic Radio works like a normal radio, but also here a second layer of interaction has been added. In addition to enabling the user listen to typical radio-channel frequencies, there is another hidden receiver detecting frequencies around 50 Hz, i.e., electric fields emitted by active electronic appliances. This second receiver then controls the normal one, making it tune out as it detects these electric fields. In practice this means that the radio will start to detune and then eventually loose its channel completely as energy use increases around it. To be able to use this radio, you therefore also have to pay attention to how the energy consumption around it changes.

Fig. 1 & 2. The Energy Curtain (Panel Version) and the Erratic Radio

5.3 Comments

Both the Energy Curtain and the Erratic Radio are speculative designs. Though our experiences so far indicate that they do challenge people to think about these matters, it is at this point not possible to say much about if and exactly how they change the way people relate to energy. But this is not only a question about persuasion efficiency, but also about the kind of dialogue between design, object and use that the notion of persuasion in design seems to open up.

Inspired by studies of how objects shape the way we think and act, we have tried to use physical interactions with things as a way of giving rather complex issues a concrete form. In these examples, there is an intention to build on a tension between an everyday, or 'old', understanding of the object and the 'new' picture provided by the redesigned thing. Both the curtain and the radio work like ordinary curtains and radios, at least in the sense that one can use them like one is used to operate such things. This way, we tried to avoid creating an entirely new context, as we wanted to intervene with already established patterns of use, thereby perhaps also making the user more closely associate these new experiences with energy consumption in general.

6 Concluding Remarks

Using examples spanning from design philosophy to critical design, I have tried to illustrate that we find strong relations to foundational issues in persuasive design in a variety of areas of design discourse, including areas that at first could be seen as being at its fringes. On basis of this overview, I argued that design can be seen as inherently persuasive and that objects can be understood as a kind of arguments in material form.

My final remark, then, would be to suggest that we should try to avoid developing persuasive design into a very specialised area like so many areas of technology development have become, but instead build on the observation that this research deals with central aspects of what design is about. From such a position we may take on the challenge of how to develop design to more consciously deal with issues of persuasion. Not primarily because we want to persuade people, but because we need to understand the persuasive dimension of the dialogue between object and user that seems to be going on as we use things. Otherwise we will never fully understand the difference between 'using' and 'being used'.

Acknowledgements

The author wishes to thank friends and collaborators in the Design and Power studios of the Interactive Institute and at the Center for Design Research. Special thanks also to Thomas Binder, Berry Eggen and Wijnand IJsselsteijn.

The Energy Curtain was made by Anders Ernevi, Margot Jacobs, Ramia Mazé, Carolin Müller, Johan Redström and Linda Worbin. The Erratic Radio was made by Anders Ernevi, Samuel Palm and Johan Redström. The Static! project is funded by the Swedish Energy Agency (STEM).

References

1. Akrich, M (1992) The De-Scription of Technical Objects. In Bijker, W and Law, J (eds.) *Shaping Technology/Building Society*, pp. 205-224. MIT Press.
2. Borgmann, A. (1995) The Depth of Design. In Buchanan, R. and Margolin, V. (eds.) *Discovering Design*, pp. 13-22. The University of Chicago Press.
3. Buchanan, R. (1989). Declaration by Design: Rhetoric, Argument, and Demonstration in Design Practice. In Margolin, V. (Ed.): *Design Discourse; History, Theory, Criticism*, pp. 91-109. The University of Chicago Press.
4. Dant, T. (2005). *Materiality and Society*. Open University Press.
5. Dunne, A. (1999). *Hertzian Tales; Electronic products, aesthetic experience and critical design*. RCA CRD Research publications.
6. Ernevi, A., Jacobs, M., Mazé, R., Müller, C., Redström, J., and Worbin, L. (2005). The Energy Curtain: Energy Awareness. In Redström, M., Redström, J. and Mazé, R. (Eds.) *IT+Textiles*, p. 91-96. Edita Publishing/IT Press
7. Ernevi, A., Palm, S. and Redström, J. (2005). Erratic Appliances and Energy Awareness. In *Proceedings of the Nordic Design Research Conference ~ In the Making ~,* May 29-31, 2005, Copenhagen, Denmark.
8. Fogg, B.J. (1998). Persuasive Computers: Perspectives and Research Directions. In *Proceedings of CHI 98*, pp. 225-232. ACM Press.
9. Fogg, B. J. (2002). *Persuasive Technology: Using Computers to Change What We Think and Do*. Morgan Kaufmann Publishers.
10. Gibson, J.J. (1979). *The Ecological Approach to Visual Perception*. Lawrence Erlbaum Associates.
11. Hunt, J. (2003). Just Re-Do-It: Tactical Formlessness and Everyday Consumption. In Blauvelt, A (ed.) *Strangely Familiar - Design and Everyday Life*, pp. 56-71. Walker Art Centre, Minneapolis, USA
12. Ihde, D. (1993). *Philosophy of Technology; An Introduction*. Paragon.
13. Ihde, D. (2002). *Bodies in Technology*. University of Minnesota Press.
14. ISO 9241-11. Ergonomic requirements for office work with visual display terminals (VDTs) - Part 11: Guidance on usability. 1998.
15. Krippendorff, K. (2006). *The Semantic Turn; A New Foundation for Design*. Taylor & Francis.
16. Marcuse, H. (1991). *One-Dimensional Man: Studies in the Ideology of Advanced Industrial Society*. Routledge.
17. Norman, D.A. (1993). Cognition in the Head and in the World: An Introduction to the Special Issue on Situated Action. In *Cognitive Science* 17:1, pp. 1-6.
18. Redström, J. (2005). On Technology as Material in Design. In Willis, A-M. (ed.) *Design Philosophy Papers: Collection Two*, pp. 31-42. Team D/E/S Publications.
19. Redström, J. (2006). Towards User Design? On the shift from object to user as the subject of design. In *Design Studies* 27:2, pp. 123-139.
20. Winograd, T. and Flores, F. (1986). *Understanding Computers and Cognition; A New Foundation for Design*. Ablex Publishing Corporation.

The PowerHouse: A Persuasive Computer Game Designed to Raise Awareness of Domestic Energy Consumption

Magnus Bang, Carin Torstensson, and Cecilia Katzeff

Interactive Institute, SE-632 20 Eskilstuna, Sweden
{magba, carin.torstensson, cecilia.katzeff}@tii.se

Abstract. Persuasive technologies can be useful to modify behaviors related to energy usage. In this paper, we present the PowerHouse a computer game designed to influence behaviors associated with energy use and promote an energy-aware lifestyle among teenagers. This prototype game aims to influence a set of target activities in the home using several persuasive techniques. Employing the format of a reality TV show (docu soap), the game informs implicitly and explicitly about various energy-efficient actions. We discuss our overall game design and its advantages and disadvantages in relation to the methods we have employed in the game.

1 Introduction

The increasing consumption of energy is a problem that affects the environment worldwide [1]. The rising energy prices – as a result of the demand – are also having far-reaching consequences on the global economy [2]. Governments throughout the world are promoting the development of renewable energy sources and various international agreements aim to restrain emissions, for example, the release of CO^2. However, our *personal energy consumption behavior* remains relatively unchallenged.

Over the last 30 years, the electricity usage has increased about 50 percent [3] and there is a potential to cut consumption significantly in the domestic environment [4]. A challenge in this work is to increase peoples' knowledge about how to use energy efficiently in *relation to everyday activities* in the home.

Our research aims to explore new designs and approaches that can be employed to raise awareness of energy-related issues and change the use patterns. We believe that persuasive technologies – particularly computer games – can be useful to reach out and change the patterns of energy usage. People are increasingly playing computer games and this can be seen in the overall world sales of gaming consoles and entertainment software packages that peaked 7.3 billion dollars in 2004 [5]. Interestingly, computer games seem to be particularly powerful to influence decision-making and influence behavior. According to Fogg, computer games have a natural persuasive power and they implement various kinds of persuasive approaches to create a high-quality gaming experience [6]. Games and media specifically designed to influence behavior have also

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 123 – 132, 2006.

been developed for various domains such as healthcare [7,8] and military applications [9]. However, few games have been developed specifically to target energy usage behaviors.

In this paper, we present the PowerHouse, a computer game developed to motivate young people to increase their interest in energy-related issues and promote efficient use of energy in their homes. The game employs a set of persuasive technology methods presented by Fogg [6] and others. We describe the overall game design, particularly it's embedded persuasive strategies and finally we conclude the paper with a general discussion on tradeoffs between persuasion and gaming experience.

2 Persuasive Technology and Computer Games

The fact that people play computer games regularly has drawn interest from both researchers and public authorities and they are now exploring if computer games can be a new approach to inform the public. Early edutainment approaches on the Internet teach visitors about certain subjects, for example how to prevent a cold or how it is to be a refugee. These games are often humoristic and they seek to make the formal information appear less burdensome. We will now discuss a set of methods and theories that we have employed in the design of the PowerHouse.

One of the persuasive powers of games originate from that they are *simulated environments*. Within the micro-world of a game users can safely explore cause-and-effect relations and uncover new behaviors. Simulation can be used to convince in different ways, for example, to direct execution to specific tasks and let people rehearse target behaviors (learning loop) [ibid.]. This method has for a long time been employed in the flight industry in their simulators. Moreover, it is employed in the game the Sims [10] where the players create and guide a set of characters in a simulated world.

Operant conditioning is a well-known and controversial method that applies positive reinforcements to change someone's behavior [11]. It can also be used negatively, that is, punishing instead of rewarding, but this method can be seen to be unethical and will not be a part of this discussion. Operant conditioning is used frequently in computer games, for example, by means of positive sound and visual reinforcements. Accumulated points, level progressions, high-score lists and game comparisons can also be seen as operant conditioning approaches.

Cognitive and social scientists have studied memory and persuasion on a theoretical level and this research also applies to game design. For example, according to Chaiken and colleagues are there two principal modes of persuasion depending on how people process information; *systemic and heuristic cognitive processing* [12, c.f., 13]. Deep systemic processing takes place when subjects are involved actively in a discussion and scrutinize arguments and facts logically. This mode seems to strengthen attitude-behavior correspondences and prolong beliefs over time [14]. In the latter mode of thinking people are not examining deeply the core issues, but are instead influenced by superficial cues such as physical attractiveness, trustworthiness, and peer group expectations.

Naturally, developers could take the dual process persuasion model as a starting point and incorporate events in the game that require both local thinking and more

superficial cues such as having attractive characters. However, a general difficulty – from a design point of view – is to entail deeper cognitive processing that not impairs the gaming experience. One approach could be to use heuristic cues to direct behavior and attention to issues that require logical thinking and reflection. We will return to this difficult issue in the reminder of the paper.

Related to the above issue are peoples' needs to fit in socially. Creating archetypical characters that the gamers can identify with makes it easier to send the message. For example, in the edutainment game *Kalas med Rut & Knut* (eng., Party with Rut and Knut) the designers have attempted to match the personalities of the characters to the target group, that is, kids between 5 and 8 of age [15]. In this game, players follow other kids and play with them to learn basic mathematical and language skills in relation to everyday activities in the home. Moreover, another approach game designers can employ is to let gamers design their own characters.

Nonetheless, it's likely that the game will improve its persuasive power if it has an attractive user interface, physically attractive characters and match the identification processes of the target group.

Finally, it can be beneficial to *combine several methods* in a computer game to further reinforce learning and persuasion. Let us exemplify; people that are in a good mood are more easily persuaded [16,17]. Moreover, according to Fogg, intervening at the right time is imperative when attempting to influence someone [6]. In a computer game one can merge these two approaches. One way to do this is to keep the player in a good mode, for example employing humor and praise, and subsequently provide suggestions and hints – that is, provide the message we want to convey – to the user just before he or she is going to perform a task.

In the remainder of the paper, we shall discuss how we combined humor, timing and praise in a persuasive loop to influence the gaming actions. However, before we discuss the actual persuasive methods in our game, let us motivate the design.

3 Survey

Preceding the actual game design, we conducted a pre-study to gain more knowledge about our target group – teenagers between 13 and 18 of age. This survey was carried out to learn more about their *attitudes* towards saving energy and gain an *understanding* on their knowledge of energy use in the home. The overall aim of the study was to produce a baseline of which we later can measure changes in attitude and comprehension after subjects have played our game.

A questionnaire was administered to 100 teenagers – both male and female. It consisted of two questions that targeted attitudes towards energy and the environment, and the following questions asked the subjects to rate – on a ten-point scale – how much energy different activities in the home consume.

As we have depicted in Figure 1, about 70% of the teenagers saw saving energy to be important and only 7% considered it to be unimportant. The difference between boys and girls attitudes is negligible.

Table 1 shows a representation of the subjects understanding of domestic energy usage. The domestic activities are ordered according to the proportion of correct

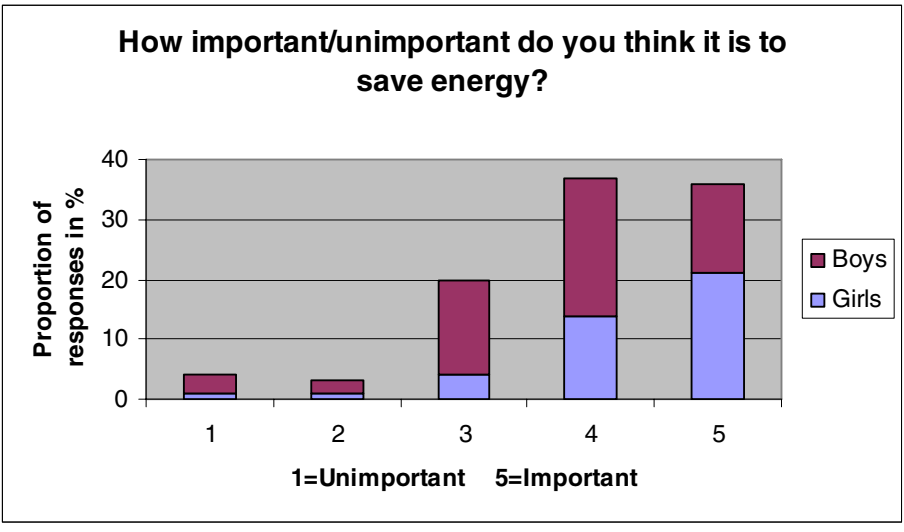


Fig. 1. Attitudes toward saving energy by teenage boys and girls aged between 13 and 18

Table 1. Proportion of correct responses for questions on how much energy different activities in the home consume

Domestic activity	Intervals on 10-point scale judged as correct	Proportion of correct responses in %
Run a dishwasher for 1.5 hours	4-7	71
Heat food in an ordinary electric oven for 20 minutes	4-7	63
Run a washing machine for 2 hours	4-7	57
Energy saving light bulb burning for 5 hours	0-2	55
Using the computer for 2 hours	0-3	45
Heat food in micro oven for 3 minutes	0-3	35
60 W light bulb burning for 5 hours	0-3	31
Playing music on stereo for 3 hours	0-3	19
Watching TV for 3 hours	0-3	16
Take a hot shower for 10 minutes	8-10	13
Take a bath for 30 minutes	8-10	12

responses and do not correspond directly to the arrangement in the questionnaire. The answers were interpreted according to a relative scale and hermeneutic understanding of domestic energy consumption.

We found that the teenagers' knowledge on how much energy is being used by the different activities in the home is generally quite low. Only for four out of the eleven

activities was the correct response rate over 50%. Particularly notable is that correct responses were very few for activities extremely common for teenagers, such as watching TV and taking a shower.

To conclude, our pre-study indicates that although teenagers' in general thinks it is important to save energy, they lack knowledge on how much energy different activities in the home consume. Thus, a mismatch seems to exist between attitude and actual behavior. However, if they learn how they can contribute and save energy, we could bridge this mismatch. Accordingly, we decided to design a persuasive game with the objective to help players save energy – particularly – elucidate the relationships between energy consumption of ordinary activities in the home.

4 The PowerHouse

The PowerHouse is a computer game designed to motivate teenagers to increase their interest in energy-related issues and promote efficient energy use in their homes. To appeal to this particular group, we decided to adopt the popular television format of a

Fig. 2. In the PowerHouse, the game player manages a simulated domestic environment with seven characters. The meters in the lower pane displays a specific character's mental and physical state. In the upper right corner are the money and power meters that show the accumulated points and how much energy is being consumed.

reality TV show (docu soap) where people live together in a closed house (e.g., Big Brother). In the PowerHouse, a player manages a simulated domestic environment with seven characters. Figure 2 shows the environment in which the characters live.

Similar to the game the Sims [10], our characters have different personalities and basic needs and the player must meet these wishes such as letting them eat and sleep. The objective is to keep the residents within the house as long as possible and nourishing the characters and letting them do things they like. If a character gets annoyed he/she leaves the house eventually.

Almost all activities in the game require electrical energy such as taking a shower, washing clothes, cook, and watch television. Hence, the objective is to direct the characters to perform the appropriate energy-efficient actions. The outcome of the proper actions is income in terms of virtual money and better game control. The money can be used to buy different artifacts and services so that the inhabitants feel good in the short term, but also to improve the energy efficiency of the house, for example, buying an energy-efficient refrigerator. Thus, the player has to balance the available resources (short and long term choices) and aim towards a more sustainable lifestyle. To be able to motivate and influence the game players and modify their behaviours towards a more energy-efficient lifestyle, we have explicitly applied several techniques and we will discuss these methods in the following section.

5 Persuasive Methods in the PowerHouse

The PowerHouse can be seen as a simulated environment that models the energy consumption of different activities in a home. If someone is taking a long hot shower the energy meter will show this immediately and the money meter will drop. Moreover, since the player can explore safely the cause-and-effect relationships of different mundane activities and get instant feedback, we expect the players to try out different behaviours and configurations several times and reinforce the learning. For example, we hope that the players will perceive the differences in outcome of both the short- and long-term behaviours, such as what happens if the shower is changed to a luxury massage shower.

As we have discussed earlier, the persuasive power of a game could be improved with a nice-looking user interface and attractive characters that users can identify with. For this reason, we have involved the users early in the design process. In several design meetings, we discussed the game scenario and the teenagers provided us with a set of archetypical characters and an outline for the graphic design. Examples of the characters are Tyra – the feministic girl who is dressed in black and doesn't eat meat – and Emile – the football player who wants to play in the Italian football league and showers twice a day.

Operant conditioning is a crucial component in almost every computer game. In the PowerHouse, we have applied different kinds of conditioning. Sound and visual effects attuned to the target group have been implemented to motivate users to stay at the computer. Meters state how much time that is left of the game together with the players' accumulated points (money). Moreover, a high-score list was implemented so that the players can compare their results, and this will hopefully encourage them to compete. The player also gets direct feedback in terms of bonus points immediately

after executing a correct behavior in the game, for example when the microwave is used instead of the ordinary electrical oven. Naturally, the goal is to encourage players and direct them to perform the right actions.

Intervening at the right time has been discussed earlier in the paper. In the PowerHouse, players are provided suggestions before task completion. These suggestions are provided by a special character that has the role of a TV host (c.f., the TV show Big Brother). The host helps players and provides special hints that – if followed by the player – boost up the points. A typical case is when a character is directed to go to the kitchen. The TV anchor says: "well…if you use the dishwasher – and not doing the dishes under flowing water – you will get some extra points". Additionally, the TV host persuades through praise, for example, after the gamer has accomplishing a task appropriately.

More generally, we have aimed to implement a persuasive timing loop to reinforce our message. Here, the attempt is to incorporate several elements such as timing, conditioning and persuading through praise that are being distributed over time. For example, if the player is taking his character to the washing machine the TV-host will give him some explicit hints (timing). This is exemplified in Figure 3.

If the player follows the advice we implicitly plant some information (cool sound effect and/or message) followed by some additional bonus points (conditioning/reward).

Fig. 3. If a player is taking a character to the laundry the TV host provides explicit hints on how to reduce the energy consumption of this activity

The player is now hopefully in a good mood and hence disposed for additional persuasion and we follow up this by some implicit or explicit message. Finally, the TV-host will praise the player or provide a general hint (praise/reward).

Naturally, successive strategies such as these are difficult to employ so that they not become obtrusive and impact the gaming experience negatively. We will discuss this in the following section. Figure 4 shows the concept of the persuasive timing loop of the PowerHouse.

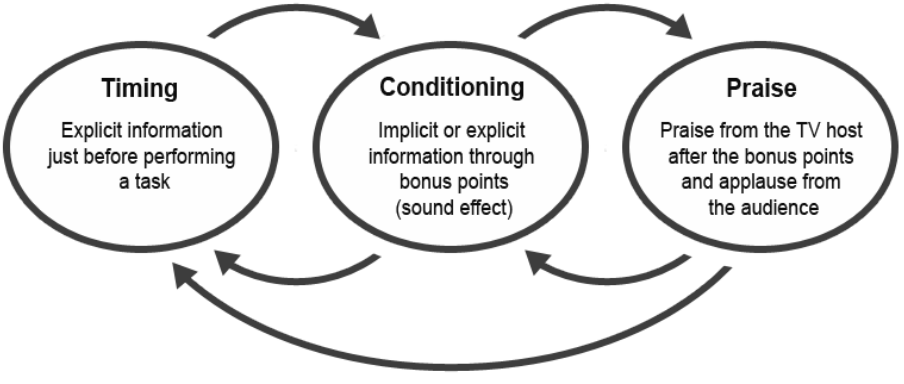


Fig. 4. The persuasive timing loop employed in the PowerHouse

6 Discussion

The objective of our game design was to increase players' interest in energy-related issues and improve their knowledge on energy-consuming activities in the home. We are now setting up a study to evaluate the game and the efficacy of its integrated persuasive methods. Of particular interest is to see how it affects attitudes and understanding of our subjects. In this study, 20 teenagers between 13-15 years will be asked to play the PowerHouse. After the session they will fill out the same questionnaire we employed in the baseline survey. They will also be interviewed about the game play experience. In this way we expect to see a differentiation among the baseline study and game player groups respectively, particularly in terms of increased understanding of how much energy different activities in the home consume. Moreover, we expect to gain knowledge on how they conceived their gaming.

A pronounced challenge for edutainment game designers is to balance the tradeoff between persuasive methods/information and the overall gaming experience. Too much praise and explicit information can naturally impair the gaming experience negatively. The experienced game designers in our team also raised this question early in the project. They wanted to avoid explicit information such as information and pop-up boxes.

To understand this tradeoff, we have designed the game so that we can explore the effectiveness of the different embedded persuasive techniques in greater detail. For example, we can modify the level of praise, turn the program host and his hints on and off, and also provide more or less explicit information upfront. Thus, the game can be seen as a platform where we can evaluate more generally the effective persuasive methods for game design.

7 Summary and Conclusion

In this paper, we have presented a computer game designed to influence everyday behaviors of energy-consuming activities in the home. The game employs several implicit and explicit techniques to reinforce learning about how to save domestic energy without being obtrusive. We are currently fine-tuning the game platform with its configurable persuasive methods with the goal to balance the explicit persuasive approach and maintain a good gaming experience. Subsequent empirical studies will tell if our approach is successful to learn about energy and if it can modify energy-related behaviours in the home.

References

1. Watson, R.T. (ed): Climate Change 2001: Synthesis Report. United Nations Report: UNEP/IPCC(02)/C632/2001. Cambridge University Press, Cambridge (2001)
2. Organisation for Economic Co-operation and Development: World Energy Outlook 2005. OECD Publishing (2005)
3. International Energy Agency: Key World Energy Statistics 2005. IEA Books, Paris (2005)
4. Haakana, M., Sillanpää, L., Talsi, M.: The Effect of Feedback and Focused Advice on Household Energy Consumption. 1997 Summer Study Proceedings. European Council for an Energy Efficient Economy (1997)
5. Entertainment Software Association: 2005 Sales, Demographics and Usage Data: Essential Facts about the Computer and Video Game Industry. Entertainment Software Association (2005)
6. Fogg, B.J.: Persuasive Technology, Using Computers to Change What People Think and Do. Morgan Kaufman Publishers, San Francisco (2003)
7. Public Health Agency of Canada: http://www.phac-aspc.gc.ca/dca-dea/injury/en/jeu.html
8. Ijsselsteijn, W.A., de Kort, Y.A.W., Westerink, J., de Jager, M., Bonants, R.: Virtual Fitness: Stimulating Exercise Behaviour through Media Technology. Presence, Teleoperators and Virtual Environments. In Press.
9. The United States Army: The official U.S. Army Game: Available at: http://www.americasarmy.com
10. Electronic Arts Incorporated. Available at: http://thesims.ea.com/
11. Skinner, B.F.: Science and Human Behaviour. The Free Press, New York (1953)
12. Chaiken, S., Lieberman, A, Eagly A.: Heuristic and systemic information processing within and beyond the persuasion context. In: Uleman, J., Bargh, J. (eds.): Unintended thought. Guilford, New York (1989) 212-252
13. Norman, D.: Things that make us smart: defending human attributes in the age of the machine. Addison-Wesley, Reading, MA (1993)

14. Cacioppo J., Petty R., Kao C., Rodriguez R.: Central and peripheral routes to persuasion: an individual difference perspective. Journal of Personality and Social Psychology Vol. 51, No. 5, (1986) 1032-1043.
15. Pan Vision AB: Kalas med Rut och Knut. Pan Vision (2003)
16. Morkes, J., Kernal, H.K., Nass, C.: Humor in Task-Oriented Computer-Mediated Communication and Human-Computer Interaction. Proceedings from the Conference on Human Factors in Computing Systems, New York; ACM Press (1998) 215-216
17. Elsbach, K.D., Barr, P.S.: The Effect of Mood on Individuals' Use of Structured Decision Protocols. Organization Science, Vol. 10, No. 2, (1999) 181-198

Break the Habit! Designing an e-Therapy Intervention Using a Virtual Coach in Aid of Smoking Cessation

Jorne Grolleman, Betsy van Dijk, Anton Nijholt, and Andrée van Emst

Human Media Interaction, Department of Computer Science
University of Twente, P.O. Box 217, 7500 AE, Enschede – The Netherlands
j.j.grolleman@alumnus.utwente.nl,
e.m.a.g.vandijk@ewi.utwente.nl, a.nijholt@ewi.utwente.nl,
avanemst@stivoro.nl

Abstract. E-therapy offers new means to support smokers during their attempt to quit. An embodied conversational agent can support people as a virtual coach on the internet. In this paper requirements are formulated for such a virtual coach and a global design is proposed. The requirements and the design are based on an extensive analysis of the practice of individual coaching of the Dutch organization STIVORO. In addition, the outcomes of a survey research measuring the acceptance of such a virtual coach by a potential user group are described.

1 Introduction

Smoking poses a major threat to public health. The toxic chemicals from cigarettes cause respiratory and cardiovascular diseases and cancer having a negative effect on the quality of life, often with fatal consequences. In The Netherlands around 20,000 people die every year because of first-hand smoking, being one of the leading causes of death[1]. To quit smoking is a big challenge for most people because of the highly addictive nature of the habit. Most people quit without using any aid, but this is proven to be highly ineffective. The most promising aid during an attempt is individual coaching combined with some form of nicotine replacement [10].

Besides the effects on public health, smoking puts a financial burden on public health services. To reduce these effects the organization STIVORO for a smoke-free future develops and implements health promotion programs on smoking cessation directed at interpersonal, organizational, community and public policy levels. STIVORO is planning to implement individual coaching consisting of six face-to-face sessions of 45 minutes.

Because of the rise of internet technology the use of e-therapy provides new possibilities to intervene in a cost-effective way. The advantages of e-therapy are the small barriers for smokers to adopt a program, continuous availability and the opportunity for smokers to interact and provide social support. At this time several informational websites, newsgroups, forums, e-mail services and quit programs are available through the internet.

[1] http://www.nationaalkompas.nl Gezondheidsdeterminanten\ Leefstijl\ Roken, 16 mei 2005

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 133 – 141, 2006.

Standard e-therapy initiatives suffer from high dropout rates [14]. Using an embodied conversational agent (ECA) could be a way to increase adherence through social interaction in an intuitive and entertaining way. Research shows that using an ECA instead of a normal text interface creates more arousal, trust and commitment [8]. As mentioned the individual coaching proves to be effective. Deployment of an ECA in the role of a personal coach could be a new effective way to support people in the process of quitting smoking. This paper describes a design proposal of a virtual coach using the individual coaching practice of STIVORO as a blueprint.

2 The Design Process

Figure 1 shows the structure of the design process of the virtual coach. The virtual coach is planned to be used as a health promotion program to reduce the number of smokers. When designing such a program the use of a scientific design method increases the chance the program will work out effectively. In the design process of the virtual coach aspects of the Intervention Mapping (IM) protocol are applied [2]. This protocol emphasizes the importance of identifying a target population, the use of empirical data to support design choices, and thinking of the consequences of delivering a message through a certain medium. The IM protocol also focuses on the use of a theory-base to justify the design choices.

When designing an ECA four main areas need close attention to ensure the ECA will have its unique and anthropomorphic character. Personification of an ECA is

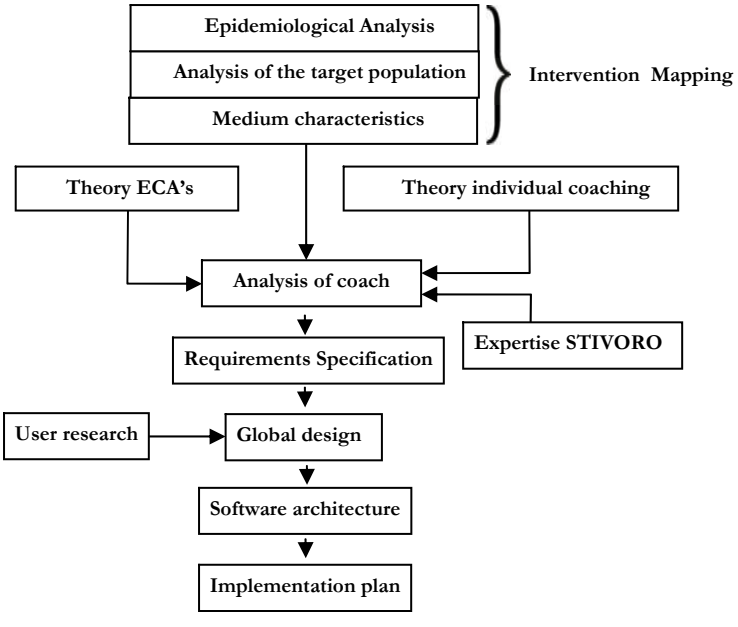


Fig. 1. The design process

possible with a physical, expressional, conversational and emotional point of view [9]. The design process was structured to first analyze the behavior of the coach in practice through analysis of an instruction DVD, the use of literature and relying on the expertise of STIVORO for unspecified matters. The analysis focuses on the four mentioned themes and forms the basis for a requirements specification. The analysis is based on a wide range of literature regarding conversational aspects, emotion and personality classifications and especially literature on the functions and execution of nonverbal behavior.

Based on the analysis requirements were specified. The information gathered in the above-mentioned design steps is used to specify the global design. The design of the software architecture is based on a modular implementation. A prototype that can be developed within reasonable time and a future prototype, describing the planning of the expansions with additional modules, are proposed. Finally, the level of acceptance by potential users is investigated by a user survey.

3 An ECA as a Tutor, Friend or Social Worker

A coach to help smokers in their struggle to break their smoking habit can be described as a mountain guide with whom you climb to the top. In the process of climbing the coach has the role of tutor to give advice and of a social worker to provide emotional support. During the journey to the ultimate smoking abstinence a coach strives for a working alliance with the client, in some aspects comparable to friendship.

When looking at the available literature on ECA's that represent the latter roles, several examples come up. An animated pedagogical agent [7] representing a teacher should have a lifelike human appearance, avoid repetition in movements [20], take the emotional state of the student into account [15] and make use of non-verbal feedback [20]. An emotionally intelligent embodied tutor agent tries to be sensitive to the mental state of the student that interacts with it and uses these affective parameters to determine the course of the dialogue [6]. A relational agent makes use of techniques to evoke a long-term socio-emotional relationship, providing continuity through remembrance of history and management of future expectations [3]. To facilitate human-ECA friendship the ECA should adopt characteristics (personality, attitude) that are similar to those of the user [17]. However, for a virtual coach a friendship relationship is not necessary. A caring agent shows empathy in favor of therapeutic goals and creates a social bond to improve the working alliance.

3.1 Caring ECA's

Examples of interventions in favor of promoting public health and well-being using an embodied agent are Carmen's Bright IDEAS [12], the FearNot! Demonstrator [20], and FitTrack [3]. Carmen's Bright IDEAS is a didactive intervention that helps mothers of pediatric cancer patients to cope with the emotional, physical and financial problems that are caused by their situation. The EU project VICTEC has created the FearNot! Demonstrator, an application using virtual characters in a virtual drama to

educate children against bullying. The FitTrack software was developed to encourage students to exercise. The program consists of a daily session of 10 minutes with the agent Laura about the progress, barriers and targets of increasing physical activity. Laura makes use of speech synthesis and shows non-verbal expressions such as gestures, eye- and head movements, facial expressions and posture changes. The rationale of the ECA of Bickmore is to establish a relationship based on trust, care and social support. To evoke these matters the ECA speaks of a joint future and past, refers to their shared knowledge, uses appropriate greeting and parting actions. Research of Bickmore [3] shows that an ECA is capable of maintaining a long-lasting relationship with a user based on trust.

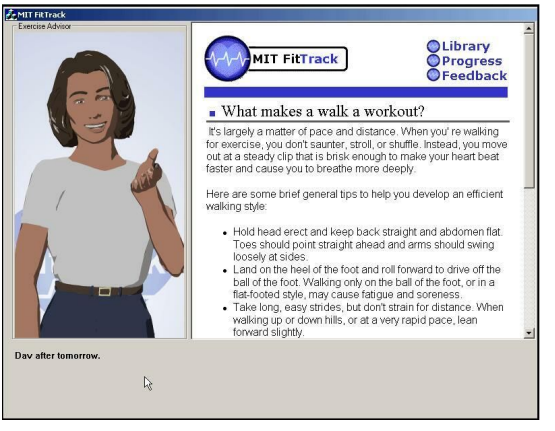


Fig. 2. FitTrack of Bickmore [3]

4 Analyzing a Coach in Practice

The behavior of a human coach in practice was analyzed using an instruction DVD of STIVORO[2]. In addition several manuals and training materials of STIVORO have been consulted, telephone coaches were observed and unspecified matters were resolved by personal communication with STIVORO.

An observation of the exterior of the coach does not reveal any peculiarities. The coach is usually a woman of average age, casually dressed and has a Caucasian ethnicity. The personality of the coach is rather neutral, non-moralizing and friendly. The use of emotions does not serve any therapeutic goal when applying motivational interviewing (to be explained later). The coach shows only modest facial expressions adjusted to the utterances of the client. These expressions are generally empathic and serious. The most frequently occurring facial expressions are shown in Fig. 3.

[2] Motivational interviewing, training for trainers/coaches. Smoking cessation. (In Dutch: Motivational interviewing, training voor trainers/coaches. Stoppen met roken.) The Hague, STIVORO, 2005.

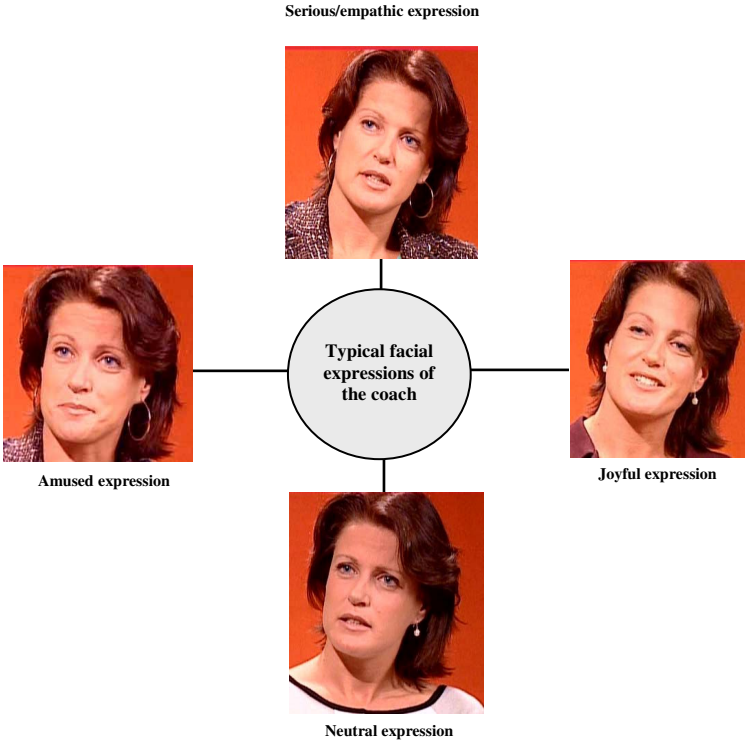


Fig. 3. The most prominent facial expressions of the coach (Source: Instruction DVD of STIVORO)

The conversation is completely determined by the theoretical framework of motivational interviewing [13]. This client-centred yet directive style of counselling has the central goal of eliciting behavior change by helping clients to explore and resolve ambivalence. The coach elicits change talk from the client by removing resistance and makes use of different strategies to improve collaboration and structure the client's thoughts. The coach uses several techniques namely reflection of emotion, content and conflict, active listening, summarizing, asking open-ended questions and provoking. The coach mostly speaks with a low volume and a low tempo to encourage the client to take the floor. Empathic utterances are often accompanied by a specific prosody.

Looking at the non-verbal communication the coach shows specific gaze behavior, encouraging head movements, only sporadically uses gestures and has a rather static but open posture. A more than regular degree of eye-contact can be observed between coach and client [1]. The analysis of the gaze behavior is based on the 'Alphabet and Lexicon of eyes' [16] a framework explaining the relationship between non-verbal signals using eyes, eyebrows and eyelids and their communicative function. The most prominent gaze behavior is depicted in Fig. 4.

5 The Global Design of the Coach

In this paragraph a feasible prototype of the virtual coach that has still to be developed will be described based on the requirements specification. The analysis of the coach in practice has brought up information about the priority of the use of the different nonverbal channels.

A first prototype of the virtual coach contains an instant messenger window visualizing a lifelike female coach from shoulders upwards. A clear interface metaphor is chosen thereby making the application also accessible for less experienced, mostly older and less well educated people. Through a chat interface conversation will be possible through unrestrained text input. The turns are sequential, there is no overlap. The coach shows gaze behavior, head movements and facial expressions. As seen in the analysis the coach utilizes only these nonverbal channels to a large extent. Implementation of only these expressions reduces the complexity of the implementation thereby saving time and money with only a minimal loss of functionality.

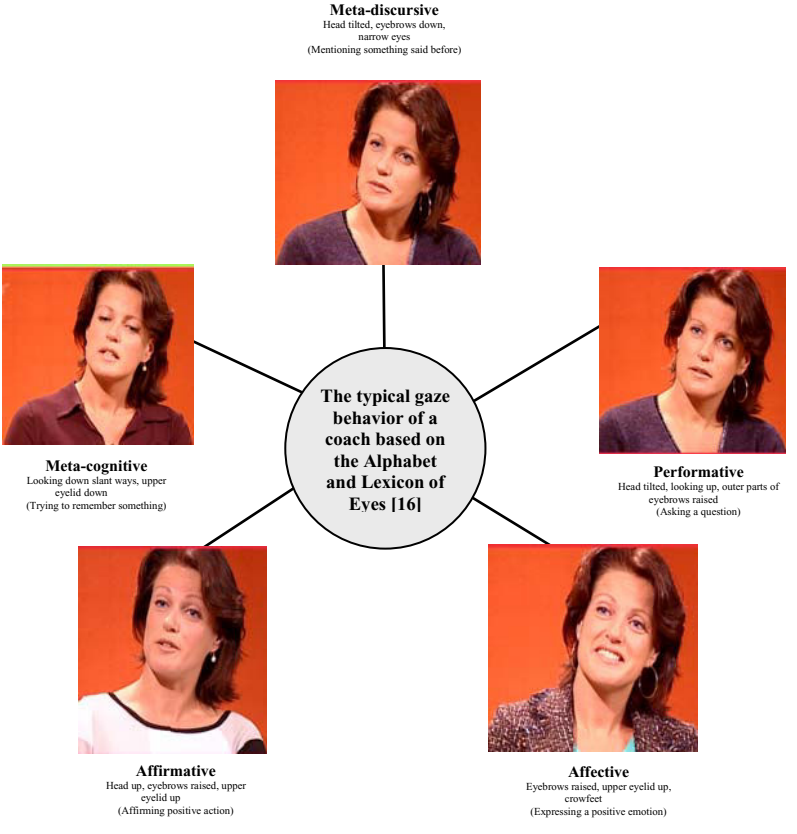


Fig. 4. Most frequent occurring gaze behavior (Source: Instruction DVD of STIVORO)

Regular interaction with chatbots does not provide the quality and conversational techniques needed for this design. The traditional ELIZA-chatbot [19] or a similar chatbot that has become available through the Loebner Prize competition[3] will be enriched with scripts that incorporate the motivational interviewing framework. Like in the design of the ECA Laura of Bickmore [3], domain knowledge and knowledge of past conversations will be incorporated in the coach to establish a relationship based on trust, care and social support. To adapt the dialogue between smoker and virtual coach to the characteristics [17] and mental state [6] of the smoker a user profile of the smoker will be built. To improve the meaningfulness of the conversation, topic parsing will enable the coach to control the course of the conversation according to the coaching protocol. Emotion parsing using an emotion lexicon will make it possible to use empathic utterances in a meaningful way.

To select gaze behavior, facial expressions, head movements and hand movements and adjust the length and timing to the output speech of the text-to-speech engine, the BEAT toolkit [4] will be used. For sophistication of the expressions, to prevent repetition and increase the anthropomorphic character of the coach, the EMOTE toolkit [5] will be used. Choosing an incremental approach some modular extensions are possible. Speech recognition, gaze detection through analysis of video images from a webcam and emotion detection based on acoustic analysis and recognition of facial expressions are future add-ons that require additional research.

6 Technology Acceptance of the Virtual Coach

When designing an intervention the major questions should be posed as to whether the program will be adopted and whether the program will be fully delivered to the target population. To get insight into the factors that play a role in accomplishing a successful adoption and implementation of the program it will help to anticipate on these factors by formulation of an adoption and implementation plan [2]. A predictor for the extent to which adoption of the virtual coach will take place is the level of technology acceptance.

To evaluate whether the proposed innovative technology will be accepted by a potential user group a survey has been conducted with 35 smoking university students wanting to quit within the next six months. Highly educated students are a population that is more likely to use the virtual coach compared to less well educated and older people because of their affinity and experience with internet and computer applications (though the latter group is gaining experience quickly).

The Unified Theory of Acceptance and Use of Technology (UTAUT model) [18] has been operationalised to measure behavioral intention to use the virtual coach. Of the respondents 49% wants to try the coach when available, 37% is not willing to use the virtual coach and the rest is still in doubt. Most respondents expect to have enough time, skills and equipment to use the technology and most of them are relatively positive about the effort they expect it will take to use the virtual coach; they expect it to be user friendly and easy to learn. The respondents are still uncertain whether the virtual coach will indeed increase the effectiveness of the quit attempt (performance expectancies).

[3] http://www.loebner.net/Prizef/loebner-prize.html

A mediating factor for the performance expectancies turns out to be the level of computer experience. The expert user seems to have a more skeptical view than the novice. Another significant mediating relationship exists between behavioral intention and the willingness to use smoking cessation aid. The influence of age differences is not taken into account because of the limited spread. There is no significant relationship demonstrated between gender and the factors of the UTAUT-model.

7 Conclusions

This paper described the background and motivation for the future development of a virtual coach to aid smoking cessation. The proven to be effective personal coaching intervention of STIVORO has been a valuable blueprint to formulate requirements for the virtual coach. A global design has been proposed in which only the most prominent nonverbal channels are planned for implementation in the first prototype. To enrich the functionality and humanness of the virtual coach a lot of work has to be done on the improvement of natural language generation algorithms. When the coach is available a reasonable part of highly educated smokers will probably use the virtual coach during their quit attempt. The virtual coach is a promising new technology that needs a lot of additional research. In this stage the development of a first basic prototype is important to get an impression of its usability and effectiveness.

References

1. Argyle, M., & Cook, M. (1976). Gaze and Mutual Gaze. New York: Cambridge University Press.
2. Bartholomew, L.K., Parcel, G.S., Kok, G. & Gottlieb, N.H. (2001). Intervention mapping: designing theory- and evidence-based health promotion programs. London: Mayfield Publishing Company.
3. Bickmore, T. (2003). Relational Agents: Effecting Change through Human-Computer Relationships, PhD Thesis, Media Arts & Sciences, Massachusetts Institute of Technology.
4. Cassell, J., Vilhjalmsson, H. H., & Bickmore, T. (2001). BEAT: the behavior expression animation toolkit. Siggraph '01, Proceedings of the 28th annual conference on computer graphics and interactive techniques (477-486). New York, NY, USA: ACM Press.
5. Chi, D. M., Costa, M., Zhao, L. & Badler, N.I. (2000). The EMOTE model for effort and shape. SIGGRAPH 2000 (173-182).
6. Heylen, D., Nijholt, A. & op den Akker, R. (2005). Affect in Tutoring Dialogues. Journal of Applied Artificial Intelligence (special issue on Educational Agents - Beyond Virtual Tutors), Vol. 19, No 3-4, Taylor & Francis, 287-311.
7. Johnson, W.L., Rickel, J.W. & Lester, J.C. (2000). Animated Pedagogical Agents: Face-to-Face Interaction in Interactive Learning Environments, International Journal of Artificial Intelligence in Education, 11, 47-78.
8. Kiesler, S. & Sproull, L. (1997). Social responses to "social" computers. In B. Friedman (Ed.), Human values and the design of technology, CLSI, Publications.
9. Kshirsagar S. & Magnenat-Thalmann N. (2002). A Multilayer Personality Model, Proceedings of 2nd International Symposium on Smart Graphics (107-115).

10. Lancaster, T., Stead, L.F. (2005). Individual behavioural counselling for smoking cessation. Cochrane Database Systematic Review, Apr 18;(2):CD001292.
11. Lester, J. & Stone, B. (1997). Increasing Believability in Animated Pedagogical Agents. Proceedings of the First International Conference on Autonomous Agents (16-21), California.
12. Marsella S., Johnson, W.L. & LaBore, C. (2003). Interactive Pedagogical Drama for Health Interventions, AIED 2003, 11th International Conference on Artificial Intelligence in Education, Australia.
13. Miller, W.R. & Rollnick, S. (2002). Motivational Interviewing – preparing people for change. New York: Guildford Press.
14. Nooijer, J. de, Oenema, A., Kloek, G., Brug, H., Vries, H. De & Vries, N. de. (2005). Bevordering van gezond gedrag via internet: nu en in de toekomst, Universiteit Maastricht: Maastricht.
15. Picard, R.W. (2001). An Affective Model of Interplay between Emotions and Learning: Reengineering Educational Pedagogy, Building a Learning Companion. Proceedings of ICALT 2001, Madison Wisconsin.
16. Poggi, I. & Pelachaud, C. (2002). Signals and meanings of gaze in animated faces. In P.McKevitt, S. O' Nuallàin & Conn Mulvihill (Eds.). Language, Vision and Music. Selected papers from the 8th International Workshop on the Cognitive Science of Natural Language Processing, Galway, 1999 (133-144). Amsterdam: John Benjamins
17. Stronks, B., Nijholt, A., van der Vet, P. & Heylen, D. (2002). Designing for friendship: Becoming friends with your ECA. In: Proceedings Embodied conversational agents - let's specify and evaluate them! A. Marriott, C. Pelachaud, T. Rist, Zs. Ruttkay & H. Vilhjalmsson (Eds.), Bologna, Italy, 91-97.
18. Venkatesh, V., Morris, M. G., Davis, G.B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, 27(3), 425-478.
19. Weizenbaum , J. (1966). ELIZA—a computer program for the study of natural language communication between man and machine. Communications of the ACM archive , 9(1), 36-45.
20. Woods, S., Hall, L., Sobral, D., Dautenhahn, K. & Wolke, D. (2003). Animated characters in bullying intervention. In T. Rist, R. Aylett, D. Ballin, & J. Rickel (Eds.). IVA 2003: Kloster Irsee (310-314), Berlin: Springer.

Persuasive Technologies in Education: Improving Motivation to Read and Write for Children

Andrés Lucero[1], Rodrigo Zuloaga[2], Selene Mota[1], and Felipe Muñoz[2]

[1] Eindhoven University of Technology, Den Dolech 2, HG 3.51, P.O. Box 513, 5600MB Eindhoven, The Netherlands
{a.a.lucero, s.a.mota-toledo}@tue.nl
[2] Universidad Tecnológica Metropolitana – UTEM, Dieciocho 390, Tercer Piso, Santiago, Chile
{rodrigo.zuloaga, felipe.munoz}@utem.cl

Abstract. In this paper we present an example of how principles of motivation can be designed into educational software to support students in achieving their goals. The objective of our software was to develop a reading habit in children between 8 and 11 years of age by motivating them to improve their reading and writing skills. By designing activities that integrate Gardner's Multiple Intelligence theory to our software, we were able to motivate children to read while acknowledging individual differences in their learning process. The results on presenting this software to different groups of children from the city and rural environments show how we were able to motivate students to read through the software itself and the activities it proposes, in a way that was credible and connected to the real-world environment children lived in. Our results show the importance of integrating principles from Persuasion such as similarity, tailoring and credibility, together with theories such as Gardner's in educational software to achieve motivation to read and write in children.

1 Introduction

Nowadays, children in western countries are reading less and less [4]. We are living in an electronic-visual era where children are much keener on browsing the internet, playing computer games and watching television than reading a good book. Books, as a communicational, educational, and entertaining experience cannot be compared to the appealing experience offered by today's technology which captures their senses through visual and audio stimuli and that have become a part of their everyday life. For example, the skills and attitudes fostered by watching television are oriented more strongly towards visual than towards linguistic stimuli [11]. However, the precipitous decline in book reading has also been a drawback to the personal process of developing their imagination. Children watch processed information whereas reading invites you to make an attempt to generate your personal world. With this as a background, we realized the importance and meaning of forming reading habits in children.

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 142 – 153, 2006.

1.1 Motivation to Read

Learning experiences are better when they come as a result of our own interest and will. These experiences are more effective when there is an emotional dimension to them or when needs to discover have been satisfied. If these basic conditions of the learning process are not met, the process usually becomes an obligation and is usually followed by boredom.

Reactions that relate to the learning process are called cognitive reactions. Among these, we can account emotions, values, and personality development. All of these build up an affective dimension. Our interest in something is nothing other than the result of our attitudes and affective experiences. It is possible to create interest for something, given the necessary conditions both in the environment and guidance.

There are many interpretations of the Motivation concept. According to Papalia [7], they are tendencies and intentions that guide individual behavior, the power that activates and drives behavior towards achieving an aim which requires the use of energy, defined objectives, and willingness to use this energy long enough to achieve this aim.

Motivation becomes an important factor when trying to motivate children to read. Children between ages 8 and 11 have very powerful physical and psychological needs for learning new things. However, human beings (and specifically children) do not have the same cognitive strengths and weaknesses [3].

1.2 User Group

We defined our user group to include children between 8 and 11 years old for several reasons. First, this stage of the reading-learning process in children is where they evolve from one-page-a-day readers to more skilful readers. It is a crucial stage in creating reading habits for children. Second, regarding the development stages of children according to Piaget [9], children at this stage are less egocentric and can engage in collaborative work better. Children are better listeners; respect each other more and can argue without fighting, expressing their point of views and reaching agreements (if necessary). Finally, they can focus on a single task without being distracted when this task is interesting to them.

1.3 Objectives

Our main objective was to create a space where children between the ages of 8 and 11 would feel motivated to rehearse and practice the target behavior of reading and writing. To accomplish the objective of developing a reading habit we designed educational software thus reaching children with the visual and audio stimuli they are so familiar with.

2 Conceptual Framework

The main question we were facing was: how do you motivate children to improve their reading and writing skills? In order to motivate children to read we defined a

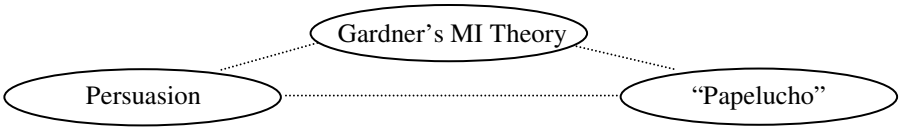


Fig. 1. Conceptual Framework. Our strategy to motivate children to read and write consisting of three main elements: Gardner's Multiple Intelligence theory, principles from Persuasion and a Chilean literary character for children called Papelucho.

conceptual framework that allowed us to address several important aspects. First, Howard Gardner's Multiple Intelligence theory helped us acknowledge individual differences in the learning process of children. Second, principles of motivation and influence were designed into our educational software to support students in achieving their goals. Third, by including a Chilean literary character for children named Papelucho we were able to reach children in a way that was appealing to them on different levels. This conceptual framework is explained in the following sections.

2.1 Theoretical Framework: Gardner's Multiple Intelligences Theory

There is a growing discontent with the classic notion of intelligence and with the current measurements of IQ. Many individuals with a low IQ, later show an outstanding ability for adaptation and great creativity. For example, Pablo Picasso was a very poor student and hardly mastered the basic literacies. How can you explain such a paradox? This example and others motivate the search for a wider conception of intelligence.

Gardner proposes the following definition of intelligence: "The ability to solve problems or to create products that are valued within one or more cultural settings" [3]. So what has been added here? Observe how a creative ingredient has been added to the classical definition of intelligence: the ability to create products. This *constructivist* conception takes into account the fact that students learn in different ways and that many pupils under typical deadlines and exam conditions seem to show poor skills to solve given problems. However, if they are given the time, encouragement, and maybe the space for teamwork, they show a remarkable ability to create products and solutions.

Gardner emphasizes how our mind is split into modules, which can be seen in the rich variety of our abilities and creative domains. We all have different skills, and different people show how skilled they can be in some areas and not in others. His Multiple Intelligences Theory claims the existence of seven separate human intelligences [3]. The first two have typically been valued in school: *linguistic* and *logical-mathematical*. The *linguistic* intelligence is the ability to communicate through language in all its forms while *logical-mathematical* involves the capacity to analyze problems logically, carry out mathematical operations, and investigate issues scientifically. The next three intelligences (*musical*, *bodily-kinesthetic* and *spatial*) are mainly connected with the arts. *Musical* intelligence is the ability to create and give meaning to sounds. *Bodily-kinesthetic* intelligence entails the potential to use one's whole body or part of it to solve problems. *Spatial* intelligence is the potential to

recognize and manipulate the patterns of wide space and of more confined areas. The final two are the personal intelligences: *interpersonal* intelligence is the capacity to understand intentions, motivations and desires of other people (i.e. social skills) and *intrapersonal* intelligence involves the capacity to discern different personal feelings and build one's own working model.

The Seven Multiple Intelligences Theory is a tool available for teachers to make a better teaching-learning process. It is a guide and a set of specific strategies that can be applied for this purpose. When teachers design new activities for their class, they must take into account how their learning styles and intelligences differ among pupils. This means teachers must look, on one hand, for diverse methods of knowledge representation and, on the other hand, design projects that motivate individuals who are particularly strong in one of the seven intelligences. This means teachers should not discourage activities in a specific intelligence for those pupils that rank low at it. Cooperative work in a multi-intelligence environment should be encouraged. We believe that new teaching strategies must consider the different intelligences.

2.2 Persuasion: Captology and Teaching as Persuasion

In the last decade, persuasion has been investigated in two apparently distinct lines of research: *captology* [2], and *teaching as persuasion*. The former is connected to the study of computers as persuasive technologies. The latter is connected on the use of persuasion as a pedagogical approach to teaching [1][5][6] and on creating training products (educational software) that motivate students to acquire new knowledge and skills. However, research in both *captology* and *teaching as persuasion* is founded on a positive view of persuasion. *Captology* is primarily related to the positive, ethical applications of persuasive technologies, focusing on the design, research and analysis of interactive computing products created for the purpose of changing people's attitudes or behaviors (without using coercion or deception) [2]. The *teaching as persuasion* metaphor seeks to change others' behaviors, their understanding judgments, or positions on a given topic by appealing both to reason and emotion [6].

A second important aspect is how the change of behavior is achieved. In *captology*, persuasion implies a voluntary change in behavior or attitude as opposed to coercion, which implies force [2]. The *teaching as persuasion* metaphor recognizes that learning involves more than assimilating new knowledge; it involves the intention to change one's ideas. Thus, the *teaching as persuasion* metaphor puts the onus for change in the hands of the learner, not the teacher. Students voluntarily decide to change their beliefs by juxtaposing individual ideas of students against those new concepts that teachers are trying to convey [10]. The veracity of persuasion depends on the importance of the issue, and the strength or credibility of the arguments, evidence, or examples presented [1]. Therefore, in our software, credibility will be a key issue to motivate children to read and write.

Persuasion and Gardner's Multiple Intelligences Theory. In education, persuasive technologies can motivate people to acquire new knowledge and skills by means of training products that tailor motivational approaches to match each individual learner [2]. Therefore, our strategy to motivate students with different cognitive strengths and weaknesses is to include Gardner's theory in the design of activities for the software.

2.3 Literary Character: Papelucho

An important aspect of motivating children to read was to find an appropriate literary character that would appeal to them on different levels, but especially, in a credible way. In our search to find such a literary character for children we came across Papelucho [8]. We chose Papelucho for his importance as a Chilean literary character for children. Both teachers and children are familiar with Papelucho at school since its 12 books are part of the suggested reading list for children in Primary education in Chile. But perhaps more important, children can easily relate to Papelucho because of his charm and magic which comes from his imagination, how he approaches daily situations, interacts with simple objects and creates extraordinary adventures with them. In this way, children can easily make a strong connection between Papelucho and the real-world environment children live in.

Papelucho and Gardner's Multiple Intelligences Theory. The creation of products is a core element in the definition of intelligence by Gardner [3]. In this 12-book saga, its author Marcela Paz portrays Papelucho as an ordinary 8-year-old boy who has an amazing ability to create and imagine new situations by interacting with his daily environment. Papelucho has the skill to create a story from simple and unexpected things. His entire environment may be subject to transformation. As such, we could design activities that incite children to create new products by using simple materials they can find both at school and at home.

Papelucho and Persuasion. In order to motivate children to read we used three principles from Captology: similarity, tailoring and credibility [2]. First, regarding similarity, Papelucho could act as a companion that children would think was similar to them and would motivate and persuade them more easily. Papelucho is roughly the same age as our user group and shares the same nationality so children can relate to the stories and environment described. Second, in correlation with the principle of tailoring, we expect children to pay more attention when they believe that messages are tailored for them since Papelucho uses the same words a child would use. Finally, regarding the principle of credibility, for fifty years now, Papelucho represents children in a good and believable way in the eyes of children, teachers and parents.

3 Design of the Software

The task of building a reading habit implies pedagogical work. We wanted to avoid creating an environment where the learning process would be associated with obligation and tied to measuring performance through tests, which usually results in rejection and somewhat of a blocking attitude from students. The pedagogical work required was focused on motivating children to develop their synthesis skills, comprehensive reading, achieving more vocabulary and ideas, critical thinking, and mastering narration structures. Game-like activities connected to the real world became an excellent tool oriented to achieve and support this pedagogical approach, as an instance of expression and free access according to personal interest and skills from students.

We needed to create a space where children could rehearse and practice the target behavior of reading and writing. In our software children can freely explore different activities according to their interests. These activities are instances where children can decide whether they want to *Read*, *Write* or *Create a Product* (game). We included game-like activities where children create products for two reasons. First, the creation of products is a core element in the definition of intelligence by Gardner [3]. Second, we were running the risk of excluding non-readers by only having writing and reading activities on the software. Therefore, by including games, children with reading habits and those who have not yet developed such habits have room for decision on what they want to do next with the software (i.e. read, write or create a product). Non-readers who are initially not drawn to reading or writing activities will be slowly exposed to the world of Papelucho by creating products and may feel motivated to read the book. Thus, the ultimate goal of the software is reached when children take one book from Papelucho's saga in their hands and read it, or when they start creating and writing their own stories with the help of the software.

3.1 Circus Metaphor

The metaphor for the interface is a circus. It is a place where diversity lives, where different characters share the same space and situations. It is a place where you can express personal motivations. A circus is a place where many creative performances take place; the happiness, enthusiasm, and creativity from the master of ceremony are critical to create this magical environment that surrounds the circus. At the circus, audience involvement is vital. Unlike at the movies or theater, here laughter, cheering, exclamations and having the audience holding their breath for a second, are part of the show. The circus metaphor together with Gardner's theory allowed us to get together in one place and reach children with differences in the stage of their learning process, in cognitive strengths and weaknesses, and in cultural and social backgrounds.

3.2 The World of Papelucho

Papelucho is the central part of this experience. His aura is present in every aspect of the software. What makes Papelucho so special is how his imagination builds these wonderful and motivating stories out of simple objects. Thus, the circus Papelucho creates should be made of simple elements found in the real world, just like the stories described in his books. If children would not believe that Papelucho created this circus from his imagination, then the entire credibility behind the software would go away.

3.3 Navigating Through the Software

Presentation. It is a short introductory animation sequence (Figure 2). The goal of this presentation is to set the user in the context of how Papelucho is lost in the countryside, on a moonlit night and finds an abandoned Circus trailer. He goes into the trailer, picks up some elements, and decides to create a Circus. As these elements are scattered downhill in a circular shape, they form the circus ring.

Circus Interface. In the main interface children can freely decide what Circus act they want Papelucho to perform. However, this Circus only runs if children actively help Papelucho prepare the acts, providing an open invitation to participate. Therefore, it is children who have to read, write or create a product and Papelucho will accompany them along the way. There are two main components to this interface (Figure 3, left). First, there is the circus trailer at the top of the hill where children help Papelucho in the preparation process of the act. Second, there is the circus ring where final acts are performed after children have finished the creation of a product.

Each of the objects that form the circus *ring* represents one *act* of the circus. For example, the stool represents the Lion Tamer act. Each *act* represents one of Gardner's Intelligences. However, children are not aware of this. It is our pedagogical goal to reach children with different cognitive strengths and weaknesses but for children, it will only be an *act*. Children access each act by clicking on the corresponding *object* (or icon). Once a given object has been chosen by a child, Papelucho places this object in the middle of the circus *ring* to begin the preparation process of the *act*.

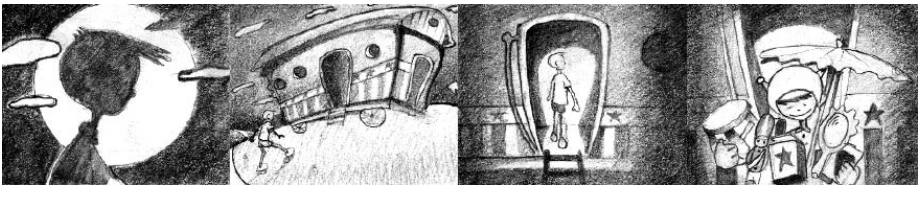


Fig. 2. Storyboard of the Presentation. Papelucho is lost in the countryside, finds an abandoned circus trailer. He enters the trailer and selects some objects he will use to create a Circus.

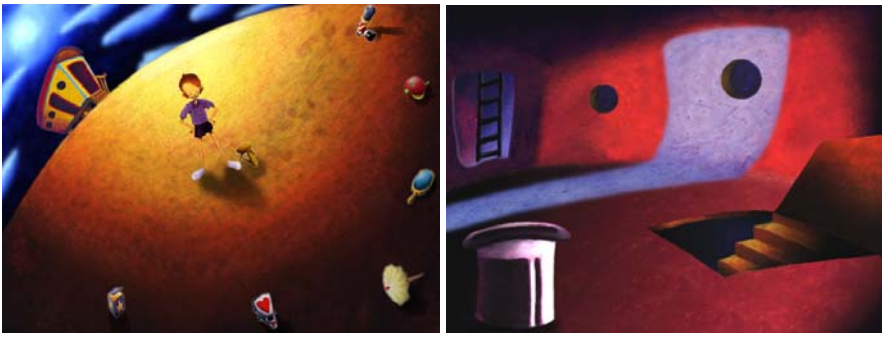


Fig. 3. Circus Interface (left). Objects scattered in a circle by Papelucho form the circus ring. Each object represents an act of the circus and one of the seven Multiple Intelligences. Circus Trailer Interface (right). Here children decide what activity they want to do by taking the ladder for reading, choosing the hat for writing or going down the hatchway for creating a product.

Circus Trailer Interface. This is a transit space where children have the chance to decide what kind of activity they want to do: *Read*, *Write* or *Create a Product* (Figure 3, right). Suggestive sentences invite children to the corresponding activities. By following the invitation "there is a *"lettery"* (starry) night!" children will use the *Ladder* that takes

them to the roof and the reading activity. By following the invitation "Let's go *storytelling* (fortune telling)!" children will go down the *Hat* which will take them to the writing activity. Finally, each act had a different invitation for the creating a product activity. In the case of the Lion Tamer act, by following the invitation "Dare to tame!" children take the *Hatchway* leading to the basement and *Create a Product*.

Reading Interface (Roof). Should children decide they want to Read, Papelucho follows them to the roof. A starry night is the perfect background for this reading session. Since Papelucho's books are structured as a diary, in our software the text children read refers to one day in Papelucho's life. This text is closely related to the intelligence chosen. The reading interface can be found on figure 4.

Writing Interface (Hat). Motivation to write is by far the most difficult thing to achieve among the three main activities. Children are given three concepts related to Papelucho and the chosen intelligence. Papelucho is disguised as a Fortune-Teller (Figure 5). With the use of a crystal ball Papelucho randomly proposes three concepts. These concepts are a character, a place, and an object that can be found in Papelucho's books. Children must link these three concepts into a story that they write down away from the computer on a real physical notebook called "the Fortune-Teller book". This is a direct link to Papelucho's diary-like format in which it is written.

Preparing the Act Interface. Should children decide to create a product, this is the place where they help Papelucho to get his act ready. Children usually need simple elements taken from their environment for this purpose, mainly things they can find at

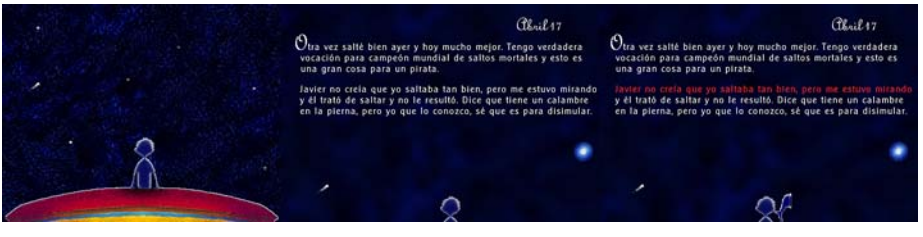


Fig. 4. Reading Interface. In the "lettery" (starry) night (left), children can read a day in the life of Papelucho (center). Children can receive assistance in reading by means of a karaoke mode where the passage is read to them out loud while text is highlighted (right).

Fig. 5. Writing Interface. Papelucho goes down the hat (left) and becomes the "storyteller" (fortune teller) to help children feel motivated to write stories (center). Papelucho proposes three concepts on the crystal ball (right).

school and at home. In this way we allow children to perform activities with the guidance of the computer at school and without the need for a computer at home. For example in the bodily-kinesthetic intelligence, children work with the software, choose an animal and follow a step-by-step tutorial on how to build an Origami figure in the shape of the chosen animal for Papelucho to tame (Figure 6). Once this figure is built, Papelucho can interact with it. Once children are familiar with the concept of building Origami animals, teachers can print a 1-page manual that children can follow step-by-step to build another animal at home without the need of a computer.

Presenting the Final Act. Offering praise for completing a task or performing a given behavior can lead to staying on task longer and getting a better understanding of the material [2]. In this case, the kind of praise is not only a virtual praise but also praise in the real world. The origami figure has the exact appearance on screen as the paper-Origami animal children chose to build. In this way, children will easily relate the paper figure they have in their hands with the animal Papelucho is taming (Figure 7). The main reason for doing this strong link between virtual and real objects is because we want children to perceive a continuum between creating an origami figure with the assistance of the computer at school and creating origami at home with the help of printed material. Similarly, this continuum is created for reading. They can read one day in the life of Papelucho on the computer at school, but they can also take the book home and read it. Thus, the experience of the software is not limited to school or to having a computer.

Fig. 6. Preparing the Act Interface. In this case, children first pick an animal (left) and then follow a step-by-step tutorial on how to build an Origami figure of the chosen animal (right).

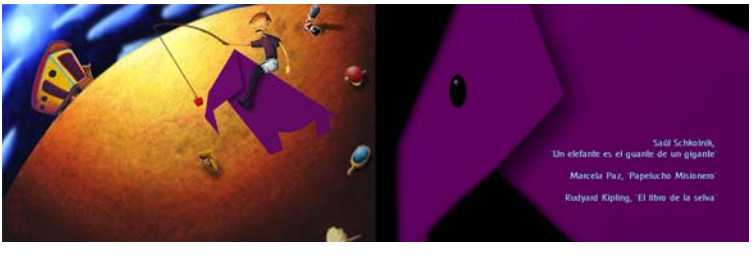


Fig. 7. Presenting the Final Act. Once students have built the paper-Origami animal, Papelucho performs the "Lion Tamer" act (left), offering children praise for building the animal. Next, a list of suggested books that children can find at school is presented (right).

At the end of the Final Act, the software attempts to motivate children to read books. It does so by offering suggestions based on a list of books that are directly related to their preferences (i.e. the animal children chose to build as an Origami figure) and that are available at school for children to borrow them.

4 Evaluation

We have conducted exploratory studies to probe the reactions of children (n=50) towards the software. Two very different audiences have tested this software: first, children from a private school in Santiago, Chile who had experienced other educational software beforehand, and second, a very particular audience: native Chilean Indians, the Mapuche. These children live in the countryside not coming often in contact with the city, had hardly ever seen a computer and were unfamiliar with Papelucho. Most of them had some kind of learning difficulty due to unclear and unstructured bilingual education in their own tongue, Mapudungun, and Spanish.

We were not performing a usability test of the system but instead we were trying to investigate two things. Our first research question was "do children feel motivated to use our software?" In this case we wanted to see whether our approach of motivating children in a way that is credible and connected to the real-world environment children live in had been successful or not, especially with such differences in the children's environments (i.e the city and rural areas). Our second research question was "are children able to create a product (i.e. building an Origami figure) regardless of differences in age (i.e. between 8 and 11 years of age), cognitive strengths and weaknesses, and socio-cultural background with the help of our software?"

Fig. 8. Evaluation. Setup with children and experiment leader (left), children building the origami figure (center) and cutting the origami figure (right).

4.1 Method

This software was tested in four different schools, one from the city and three rural. In order to address differences in both contexts (city and rural), we had two approaches. In the first case, since children from the city had experienced other software beforehand, training by the experiment leader was almost solely connected to explaining how children could interact with our software. In the second case, since Mapuche children had hardly ever seen a computer before, let alone a laptop, training sessions were first focused on introducing children to a computer including how to carry out tasks on a WIMP (windows, icons, menus and pointing devices) environment.

The second part of the training session was connected to explaining the interaction with our software. Training sessions were 30 and 40 minutes long respectively.

The evaluation itself began after the training session. Children were separated according to their class to see how they would react to building the Origami figure. We had 4 different groups of 6-9 children, one group for each age (i.e. eight, nine, ten and eleven-year olds). The eight-year olds went first because we thought more dedication would be needed for them to be able to build the figure. Children interacted with the software in these groups with the assistance of the experiment leader. Children were asked to follow the step-by-step procedure of building the Origami figure with the assistance of the software (Figure 8). Children interacted with the software for another 30 minutes, for a total evaluation time of 60-70 minutes.

4.2 Initial Results

These initial results are based both on qualitative comments made by children and on observations made by the experimenters during the evaluations. Regarding our first research question, we were first looking whether children felt motivated to use our software. Throughout the evaluation, children from both the city and rural areas were drawn to the audiovisual experience of the software, especially to its attractive illustrations, animations and original music. During the training sessions led by the experiment leader, children shared their positive feelings towards the software with the rest of the group. After a while, children who did not know Papelucho slowly started asking things about him: “where is he from?”, “where does he live?” Thus, children were able to make a transition from being impressed by the software to focus on exploring who Papelucho was. Second, our approach of motivating children in a way that is credible and connected to the real-world environment children live in made sense both for children from the city and rural areas. Because the activities presented by the software were connected to simple objects and situations (i.e paper animals, a child lost in the countryside) they made sense to both groups of children. They were equally interested in the software itself and the activities it proposes.

Regarding our second research question, all students were able to understand and follow the different steps of the process to build the Origami figure. Only 5 students had problems with the final step of cutting a specific shape with scissors. These 5 children received the support from classmates and were able to complete the cutting process. Therefore, to our amazement, both in the private and rural schools, all children were able to build the Origami figure, regardless of age, social and cultural background, and individual differences in their cognitive skills.

5 Conclusions

We have designed educational software to motivate children between 8 and 11 years of age to practice the target behavior of reading and writing. Our strategy to motivate children consisted of designing activities that consider three aspects: first, that acknowledge individual differences in the learning process of children by integrating Gardner’s Multiple Intelligence theory; second, that support children in achieving

their goals by including principles of persuasion; and third by including Papelucho as means to reach children in a way that was appealing to them.

The results of exploratory studies with children from one private and three rural schools show the software was able to motivate children to read and perform the activities it proposes in an enthusiastic way. Our approach of motivating children in a way that is credible and connected to the real-world environment of children helped us reach a very diverse audience in a way that made sense to them. By including these three aspects (i.e. Gardner, Persuasion and Papelucho) we have reached the objective of designing activities that address differences in age, cognitive strengths and weaknesses, and socio-cultural background. Our results show how by integrating principles from Persuasion together with theories such as Gardner's in educational software, audiences with age, sex, social, economic, and cultural differences can be reached using the same software and can help us motivate children, and others, to read.

Future work includes a follow-up study where the long-term impact of the use of this software in a classroom can be assessed. We will compare whether children are more motivated to read Papelucho when using the software than if the character is introduced to them in a different way (e.g. by simply listening to the story). Finally, children will be able to explore all intelligences and not only the bodily-kinesthetic intelligence where all children end up making an origami animal.

References

1. Alexander, P.A., Fives, H., Buehl, M.M., Mulhern, J.: Teaching as persuasion. Teaching and Teacher Education, Volume 18, Issue 7 (2002) 795-813
2. Fogg, B.J.: Persuasive Technology: Using Computers to Change What We Think and Do. Morgan Kaufmann (2003)
3. Gardner, H.: Intelligence Reframed: Multiple Intelligences for the 21st Century. Basic Books (1999)
4. Knulst, W.: The readership of books in times of de-reading. Poetics, Volume 31, Issues 3-4, (2003) 213-233
5. Mason, L.: The process of change through persuasion: a commentary. International Journal of Educational Research, Volume 35, Issues 7-8 (2001) 715-729
6. Murphy, P. K.: Teaching as Persuasion: A new metaphor for a new decade. Theory into Practice, 40(4) (2001) 224–227
7. Papalia, D.E., et al: A Child's World. Infancy through Adolescence. McGraw-Hill (1986)
8. Paz, M.: "Colección Papelucho", Ed. Universitaria (1997)
9. Piaget, J.: The general problems of the psychobiological development of the child. Proceedings of the World Health Organization study group on the psychobiological development of the child, Vol. IV (1960) 3–27
10. Sinatra, G., Kardash, C.M.: Teacher candidates' epistemological beliefs, dispositions, and views on teaching as persuasion. Contemporary Educational Psychology, Volume 29, Issue 4 (2004) 483-498
11. Verboord, M., van Rees, K.: Do changes in socialization lead to decline in reading level? How parents, literary education, and popular culture affect the level of books read. Poetics, Volume 31, Issues 3-4 (2003) 283-300

Communication and Persuasion Technology: Psychophysiology of Emotions and User-Profiling

Egon L. van den Broek[1,2], Marleen H. Schut[2,3],
Kees Tuinenbreijer[3], and Joyce H.D.M. Westerink[4]

[1] Center for Telematics and Information Technology & Institute for Behavioral Research,
University of Twente,
P.O. Box 217, 7500 AE Enschede, The Netherlands
e.l.vandenbroek@utwente.nl
[2] Department of Artificial Intelligence / Nijmegen Institute for Cognition and Information,
Radboud University Nijmegen,
P.O. Box 9104, 6500 HE Nijmegen, The Netherlands
e.vandenbroek@nici.ru.nl / mhschut@student.ru.nl
[3] The Innovation Laboratories, Philips Consumer Electronics,
Glaslaan 2, SFJ 507 Eindhoven, The Netherlands
{marleen.schut, kees.tuinenbreijer}@philips.com
[4] Media Interaction Group, Philips Research,
P.O. Box WB51, 5656 AE Eindhoven, The Netherlands
joyce.westerink@philips.com

Abstract. A theoretical framework for communication and persuasion technology is introduced, utilizing people's emotions and personality characteristics. It uses two unobtrusive psychophysiological measures to penetrate people's emotional space: heart rate variability and the variability of the fundamental frequency of the pitch of the voice. In addition, two experiments are described that validate these measures. Future systems can utilize such technology to sense people's emotions and adopt suitable persuasion strategies.

1 Introduction

More than half a century ago, Hovland, Janis, and Kelly [1], already described how we influence each other through communication and persuasion. Nowadays, people not only communicate to each other in a range of settings (e.g., TV, Microsoft MSN®) but also with a range of systems through several modalities (e.g., keyboard, pointing devices, speech, gestures).

The study of computers (e.g., web sites, video games, virtual reality) that communicate to and persuade their users is baptized captology. To achieve the latter, efficient man-machine interaction, using advanced communication schemes, is needed. Preferably, computer systems should sense their user's needs, as user's do of each other. Hereby, as was already denoted a decade ago [2], emotions play a crucial role.

This paper addresses the issue of non-obtrusive measurements (i.e., heart rate and speech) to unravel the emotional state of humans. To cope with interpersonal variability, personality traits are taken into account. The proposed processing scheme enables the design of persuasive technology of which the user is not even aware that it is there.

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 154–157, 2006.

1.1 Emotion

The relation between discrete emotions and persuasion has been examined since the first psychological studies to persuasion were reported [3]. Most researchers agree that emotions are acute, intentional states, which exist in a relatively short period of time and are related to a particular event, object, or action [4]. The experience of an emotion biases ones expectations of the occurrence of events or attributes of the matching emotion. These expectancies for elements of a message facilitates the development of favorable attitudes in persuasion strategies [3].

In relation with physiological measures, emotions are considered most frequently as points in a continuous multidimensional space as coordinates of affective valence and arousal [4]. The valence dimension represents overall pleasantness of emotional experiences, ranging from low (unpleasant) to high (pleasant). The arousal dimension represents the intensity level of emotion, ranging from calm (low arousal) to excited (high arousal).The valance-arousal model provides the means to describe emotions, using its two dimensions.

Despite the psychophysiological measures and the models available, the measurement of emotions is still complex due to the continuously changing emotional state of people. Moreover, the emotional state of different persons varies over the same events, objects, or actions. The latter is not only determined by a person's current emotional state, but also by its personality. Personality traits correlate with emotion states, especially with the personality traits extraversion and neuroticism, which have been linked both theoretically and empirically to valence [3]; i.e., extraversion biases individuals toward positive affect and neuroticism biases individuals toward negative affect. For example, DeSteno, Rucker, Wegener, and Braverman [3] proved that different emotions (i.e., sadness and anger) require different message content in order to achieve persuasion. Hence, individual analysis of personality in relation with both valence and arousal enables tailored analyzes of a person's emotional state.

2 Unobtrusive Psychophysiological Measurement of Emotions

Founded on the theoretical framework introduced in the previous section, we will now describe its implementation, using two psychophysiological measures. A broad range of psychophysiological measures to detect the emotional state of people has been topic of research [2, 5]; i.e., heart rate (HR), eye blinks, blood pressure, skin conductance, respiration rate, speech, EMG, EEG, ERPs, PET, and fMRI. However, most of these measures are either not feasible outside an experimentally controlled environment or will interfere with everyday life. Since our envisioned systems should be ubiquitous, its sensors should be unobtrusive; hence, speech and HR as psychophysiological measures are very useful to detect user's emotional state.

In a variety of settings, several parameters derived from speech are investigated with respect to their use in the determination of the emotional state of people. Although no general consensus exists concerning the parameters to be used, most evidence is present for the variability (defined as the standard deviation (SD)) of the fundamental frequency of the pitch (F0) (SD F0) [6]. In particular, the SD F0 is useful for measuring the (intensity of) experienced emotions [6]. However, to be able to detect the emotional state of a

person, we also need to determine the experienced valence triggered by an event, object, or action. Several researchers investigated the relationship between valence and physiological signals [2, 5]. Most research provides evidence for the variability of HR (HRV) as a measure for valence people experience [5]. Moreover, during the last decade, the apparatus to measure HR became tiny and wireless and, consequently, unobtrusive.

2.1 Method of Validation

To validate our theoretical framework and psychophysiological measures, we will conduct two similar experiments, apart from their stimuli, respectively: pictures of the International Affective Picture System (IAPS) [7] and a set of 8 film scenes. Before the experiments will be conducted, the participants will be asked to provide us with some personal characteristics; e.g., gender, age, level of education. In addition, they are asked to fill in a revised, short scale of the Eysenck Personality Questionnaire (EPQ-RSS) [8]. The data collected enables us to define a profile of the participants.

After the data is collected for the participant's user-profile, the two experiments are executed. We control the order of both the experiments (counterbalancing) and the stimuli (randomization). In both experiments, the participants will be asked to briefly describe each of the stimuli. These speech utterances are recorded and, in parallel, a continuous recording of the HR is done. Speech recording will be done using a Philips SBC ME-400 microphone that is connected to the sound card of a PC. A HR measurement belt, attached to a data acquisition tool (NI USB-6008), will record the HR.

40 IAPS pictures will be displayed for 20 seconds after which the participant has 30 seconds to describe the picture in one sentence, followed by a resting period of 20 seconds in which a gray screen is shown. Each of the 8 film scenes that will be shown have a duration of 3 minutes and 18 seconds. After each scene, the participants have 30 seconds to describe the most emotional part of the scene, followed by a resting period of 1 minute in which a gray screen is shown. Between both experiments, the participants get a break of 6 minutes. After each of the experiments, the subjects will be asked to rate the stimuli on positive and negative affect and on arousal.

3 Discussion

This paper introduces a theoretical framework for Communication and Persuasion Technology (CPT), utilizing its user's emotions and personality characteristics, as described in Section 1.1. Two unobtrusive psychophysiological measures are introduced in Section 2: heart rate (HR) and the fundamental frequency of the pitch of the voice (F0). The variability of HR (HRV) and F0 (SD F0) reflect respectively, the experienced valence and arousal. Based on previous research [2, 5, 6], the combination of the latter two measures can be expected to provide a reliable inspection of the emotion space of people. Hence, a system that receives both signals can penetrate the emotional state of its user. Section 2.1 elaborates on two experiments that can be used to validate the HRV and SD F0, as measures to intrude people's emotional space. Hence, future systems equipped with this framework should be able to react properly to the user's emotions by selecting competent (persuasion) strategies.

Designers envision electronic environments that are sensitive and responsive to the presence and mood of people. This vision is baptized: "ambient intelligence" and is characterized as embedded, aware, natural, personalized, adaptive, and anticipatory. CPT suits this vision since it is embedded (i.e., unobtrusive), it facilitates awareness for systems connected to it, it aims to mimic human empathy (i.e., is natural), includes a user-profile, is able to adapt itself to its user's changing moods, and can utilize its knowledge to anticipate on people's mood and adapt its communication and persuasion strategy.

One of the big advantages of CPT is that it is unobtrusive, by absolution of both technology, in the case of HR, and indirect measurements, for the recording of speech. However, indirect measurements are sensitive to noise; hence, technical problems will arise when CPT will be used outside controlled environments. Nevertheless, in its current setup, CPT can already be applied in a range of settings, such as therapy evaluation [6] and telepsychiatry. For example, systems can adapt both the content of their utterances and the tone of their artificial voice based on the received information concerning the emotional state of the user. In the case of web crawlers, the value of results presented by the crawler to its user can be estimated based on the CPT, as addressed in the present paper. Consequently, the user's profile can be adapted and future queries can resemble the user's interest better.

The framework for CPT, as introduced in this paper, provides the means to unraveling the intriguing feature of humans to sense the emotions of other humans. With that, a first step is made toward a new age of man-machine communication. Hence, in time, we will be able to communicate and debate with systems and challenge them to persuade us; penetrating our emotional state and using our personality characteristics.

References

1. Hovland, C.I., Janis, I.L., Kelly, H.: Communication and persuasion: psychological studies of opinion change. New Haven, C.T.: Yale University Press (1953)
2. Picard, R.: Affective Computing. Boston MA.: MIT Press (1997)
3. DeSteno, D., Petty, R.E., Rucker, D.D., Wegener, D.T., Braverman, J.: Discrete emotions and persuasion: The role of emotion-induced expectancies. Journal of Personality and Social Psychology **86** (2004) 43–56
4. Konijn, E.A., Hoorn, J.F.: Some like it bad. Testing a model for perceiving and experiencing fictional characters. Media Psychology **7** (2005) 107–144
5. Scerbo, M.W., Freeman, F.G., Mikulka, P.J., Parasuraman, R., Di Nocero, F.: The efficacy of psychophysiological measures for implementing adaptive technology. Technical Report NASA / TP-2001-211018, NASA Center for AeroSpace Information (CASI) (2001)
6. Van den Broek, E.L.: Emotional Prosody Measurement (EPM): A voice-based evaluation method for psychological therapy effectiveness. Studies in Health Technology and Informatics (Medical and Care Compunetics 1) **103** (2004) 118–125
7. Lang, P.J., Bradley, M.M., Cuthbert, B.N.: International affective picture system (IAPS): Digitized photographs, instruction manual and affective ratings. Technical Report A-6, University of Florida, Gainesville, FL (2005)
8. Eysenck, H.J., Eysenck, S.B.G.: Manual of the Eysenck personality scales (EPS Adult). Hodder and Stoughton: London (1991)

Effect of a Virtual Coach on Athletes' Motivation

Anke Eyck[1], Kelvin Geerlings[1], Dina Karimova[1], Bernt Meerbeek[1], Lu Wang[1], Wijnand IJsselsteijn[2], Yvonne de Kort[2], Michiel Roersma[3], and Joyce Westerink[3]

[1] User-System Interaction, Technical University Eindhoven, Den Dolech 2, 5600 MB Eindhoven, The Netherlands
A.M.E.Eyck@tue.nl, {Kelvin.Geerlings, DKarimova}@gmail.com, Bernt.Meerbeek@philips.com, L_Wang2001@yahoo.com
[2] Human-Technology Interaction, Technical University Eindhoven, Den Dolech 2, 5600 MB Eindhoven, The Netherlands
{W.A.IJsselsteijn, Y.A.W.d.Kort}@tue.nl
[3] Philips Research, Care & Health Applications, High Tech Campus 34, 5656 AE Eindhoven, The Netherlands
{Michiel.Roersma, Joyce.Westerink}@philips.com

Abstract. The experiment described in this paper addressed two main questions. Can a virtual coach motivate beginning athletes? Can a virtual coach influence beginning athletes exercise behavior? The results show that doing physical exercises is more enjoyable with a virtual coach than without, consequently increasing the intrinsic motivation. Also, the extrinsic motivation is increased by a virtual coach, which is indicated by higher external regulation. Finally, participants biked more in the optimal heart beat zone in the condition with the coach. Longitudinal research is needed to find out the long-term effect of a virtual coach.

1 Introduction

Technological advances (e.g. cars, automated house appliances, televisions, internet, etc.) have decreased the need for physical activity. A decline of physical activity contributes to the increase of health problems such as heart diseases and obesity. Therefore, it is essential to find ways to keep in good physical condition. One way to do so is physical exercise. However, many people find it difficult to start and persist in physical exertion. Many devices that support physical exercise, such as exercise bikes, and heartbeat monitors, are commonly available on the market. But none of these devices focus on motivating people to start and persevere physical exertion.

In psychology, two types of motivation are distinguished: intrinsic and extrinsic motivation. Intrinsic motivation is related to the satisfaction a person gets from an activity. Whereas extrinsically motivated activities are done to receive rewards, under pressure or to avoid punishment [1]. In the latter case the activity is a means to an end, e.g. losing weight. Previous research showed that especially intrinsic motivation is a very important determinant for exercise adherence [4].

Previous research showed mixed results on the effect of a virtual coach on intrinsic motivation. Effects of a virtual coach on the scales of perceived control and

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 158 – 161, 2006.

usefulness were found [7]. Yet, no effects of were found on the most important scale, enjoyment.

A conceptual design was made of a system suitable for gathering data on physiological parameters, but also interprets this data, and presents the results to the user by means of a virtual coach. The target group consisted of extrinsically motivated exercisers (whose goals are to lose weight or to stay fit), because this is the most challenging group to raise and consolidate motivation. This paper describes the evaluation of a part of the concept, namely the verbal feedback of the virtual coach.

The questions that were addressed: (1) Can a virtual coach motivate beginning athletes? (2) Can the virtual coach influence beginning athletes' exercise behavior (stay in the optimal heart beat zone)?

2 Methods

2.1 Participants, Design, and Setting

The experiment involved 20 Dutch-speaking female participants (17-28 years old, average 22). Participants were asked to cycle in each of two conditions: with coach (verbal messages) and without coach. The order of the conditions was counterbalanced. The voice of Dutch male was recorded for the sentences of the virtual coach. The principles of praise, tailoring and tunneling [2] were applied to the verbal feedback to enhance the motivation effect (see Table 1). The messages given by the coach were based on the heartbeat of participants, according to the scheme described in Table 2.

Table 1. Principles of persuasive technology used in the design

Principle	Solution
Praise	Provides positive motivational feedback to the user
Tailoring	Gives feedback to the user based on heartbeat and performance
Tunneling	Provides support during a running session in the form of verbal feedback

Table 2. Heartbeat zones for weight loss (WL), improve condition (IC) and example sentence

Zones	WL	IC	Example sentence (translated)
Very High	> 75%*	>90%*	"Your heartbeat is too high. Try to lower it by biking slowly for a while."
High	70-75%*	80-90%*	"I love your enthusiasm, but try to slow down a bit."
Keep Pace	60-70%*	70-80%*	"Now, this is perfect! Your pace is optimal to improve your fitness."
Low	<60%*	<70%*	"I am really proud that you are cycling, it would be great if you can cycle faster"

*% of maximum heartbeat (= 220 - Age)

2.2 Measurements and Procedure

To measure the extrinsic motivation of the participants, a slightly adapted version of the Self-Regulation Questionnaire (SRQ-E,) was used, as was also done in previous

research [6]. Only three out of four scales were used namely external regulation, introjected regulation, and identified regulation. These subscales differ in the extent to which behavior is internalized and integrated within the athlete [5]. The intrinsic motivation was measured after both conditions with the Intrinsic Motivation Inventory (IMI) [3]. The IMI assesses participant's interest/enjoyment, perceived competence, effort, value/usefulness, felt pressure and tension, and perceived choice while performing a given activity. The participant's heartbeat was registered to find out how often the heartbeat was outside the optimal zone. This was done to measure the influence of the virtual coach on exercise behavior.

The experimenter explained the procedure of the experiment to the participants, and asked them to fill out an informed consent and a health declaration. Next, participants filled out the SRQ-E. After that, they had three minutes for warming up and getting familiar with the equipment. All participants cycled two times 15 minutes. After each condition, they filled out the IMI. Only after the condition with coach, they filled out a second SRQ-E.

3 Results

3.1 Intrinsic and Extrinsic Motivation

For both the SRQ-E and the IMI paired t-tests were used to analyze the data. The scores on the different sub-scales of the IMI showed that participants have a higher feeling of interest/enjoyment in the condition with the coach ($t = -3.13$, $p < .01$). There is a tendency that participants feel more competent in the condition with the coach as well ($t = -1.77$, $p = -.09$). No significant differences were found for the other sub-scales (effort, pressure, perceived choice, and usefulness).

In the condition with coach, people scored higher on the extrinsic regulation sub-scale of the SQR ($t = -3.19$, $p < .01$). There was no significant difference for the other sub-scales of the SQR (introjected regulation, and identified regulation).

3.2 Exercise Behavior

The heartbeat measurements showed that more people biked in the optimal zone for improving condition (see Table 2) with the coach than without ($t = -2.15$, $p < .05$).

4 Conclusion and Discussion

This experiment contributed to the design of a virtual coach that motivates beginning athletes and influence their exercise behavior by staying in the optimal heart beat zone to improve condition.

Some conclusions can be drawn based on the results. Regarding intrinsic motivation, the interest/enjoyment is rated higher in the condition with the coach. This means that participants are more intrinsically motivated with a coach, especially because this sub-scale is the most important scale for intrinsic motivation [3]. This result was not found in earlier studies with a virtual coach [6 & 7]. A possible explanation for this difference can be the more diverse and more extensive sentences

of the coach and the principles of persuasive technology that were applied. This probably made the coach more interesting to listen to and the exercising less boring. Another explanation is that in this experiment the participants biked 15 minutes instead of 6-7 in earlier experiments, which makes the effect more measurable.

On the other sub-scales, no significant differences were found. This means that people did not feel they had put extra effort in the activity when they heard the coach and did not feel more tensed or less in control with the coach. IJsselsteijn et al. [7] found in earlier research that people felt less in control with a coach. An explanation for this difference could be that the sentences in this experiment were more suggestive than their sentences: "Your heart rate is too low, cycle faster" [7] versus "I am really proud that you are cycling, it would be great if you can cycle a bit faster" (this experiment).

The coach also increases the extrinsic motivation, more specifically the extrinsic regulation. This means that the coach is a controlling factor when doing exercises; people exercise more to receive rewards and avoid negative consequences [4].

Another positive effect of the coach was that more people biked in the optimal zone for improving stamina and preventing injuries with the coach than without. This suggests that the effect of a training will be bigger with a coach than without, which is an important aspect for the result-oriented, extrinsically motivated target group.

In general, it can be said that the coach raises motivation both intrinsically and extrinsically. However, there are some limitations concerning the outcome of the experiment. Although intrinsic motivation is an important factor for exercise adherence, it cannot be claimed that the virtual coach affects motivation of runners in the long run. Longitudinal research is needed to find out the long-term effect of a virtual coach.

References

1. Deci, E.L. Intrinsic motivation. New York: Plenum Press.
2. Fogg, B.J.: Persuasive Technology: Using Computers to Change What We Think and Do. Morgan Kaufmann Publishers San Fransisco (2003).
3. Intrinsic Motivation Questionnaire, retrieved at: http://www.psych.rochester.edu/SDT/measures/word/IMIfull.doc
4. Ryan, R.M., Frederick, C.M. Lepes, D., Rubio, N., and Sheldon, K.M.: Intrinsic Motivation and Exercise Adherence. International Journal of Sport Psychology (1997) 335-354
5. Self-regulation Questionnaire, retrieved at: http://www.psych.rochester.edu/SDT/measures/word/srqfull.doc
6. Westerink, J., de Jager, M., de Kort, Y., IJsselsteijn, W., Bonants, R., Vermeulen, J., van Herk, J., and Roersma, R.: Raising Motivation in Home Fitnessing: Effects of a Virtual Landscape and a Virtual Coach with Various Coaching Styles, Abstract of the ISSP 11th World Congress of Sport Psychology, Sydney (2005)
7. IJsselsteijn, W. A., de Kort, Y. A. W., Bonants, R., de Jager, M., Westerink, J.: Virtual Cycling: Effects of Immersion and a Virtual Coach on Motivation and Presence in a Home Fitness Application. Proceedings Virtual Reality Design and Evaluation Workshop 2004, 22-23 January 2004 University of Nottingham

Self-management of Vascular Patients Activated by the Internet and Nurses: Rationale and Design

Bertine M.B. Goessens[1], Frank L.J. Visseren[2,*], Alexander C. Geerts[1], Judith Wierdsma[2], Hubertus W. van den Borne[3], Ale Algra[1,4], and Yolanda van der Graaf[1]

[1] Julius Center for Health Sciences and Primary Care, UMC Utrecht, The Netherlands
[2] Internal Medicine, Section of Vascular Medicine, UMC Utrecht, The Netherlands
F.L.J.Visseren@umcutrecht.nl
[3] Health education, University Maastricht, The Netherlands
[4] Rudolph Magnus Institute for Neuroscience, Department of Neurology, UMC Utrecht, The Netherlands

Abstract. *Background*: Vascular risk factors are often poorly managed. A multifactor approach with the aid of nurse practitioners (NPs) is more beneficial for achieving treatment goals of risk factors than achieved with usual care in patients with cardiovascular disease (CVD). *Objective:* In the SPAIN pilot-study, we want to implement and test a secure personalized website with additional treatment and coaching of a NP for risk factors in patients with CVD. Fifty patients are going to use the patient-specific website for six months. At study begin; realistic treatment goal(s) for elevated risk factors are made between patients and the NP. Patients can enter new measurements and are stimulated to keep regular e-mail contact. The NP personally replies during working days and gives regular but protocol driven feedback and support. Data will be collected on login attempts, amount of messages, risk factor levels before and after intervention and on beliefs. Determinants of changing behaviour are collected. *Results:* The results can be expected at the beginning of 2007. *Conclusion:* This pilot-study will give insight in feasibility and satisfaction of patients and NP in electronically treatment of risk factors. Also information on the course of risk factors will be available.

1 Introduction

Cardiovascular disease (CVD) is the most common cause of morbidity and mortality in Western countries [1]. It is the result of atherosclerosis and is influenced by a cluster of risk factors, such as smoking, obesity, hypertension, hyperlipidemia, and diabetes mellitus. Modification of vascular risk factors is known to reduce the risk of vascular events and improve quality of life in persons with known CVD [2]. Yet despite this, risk factors are often poorly managed. Lifestyle changes are an important component of vascular risk reduction strategies, and not all physicians have enough

* Corresponding author: Internal Medicine, Section of Vascular Medicine, UMC Utrecht, G02.228, Heidelberglaan 100; 3584 CX Utrecht, The Netherlands.

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 162 – 166, 2006.

time or the appropriate training to advice about lifestyle changes (e.g. quit smoking, weight loss, increased consumption of fruit and vegetables, increased physical activity, decreased intake of salt and saturated fats) [3]. New strategies are required to address the high prevalence and suboptimal control of risk factors.

A number of randomized controlled trials show that a multifactor approach with the aid of nurse practitioners (NPs) is beneficial for achieving treatment goals than achieved with usual care in patients with CVD [4-6]. NPs have skills in medical and behavioral sciences needed for intensive and prolonged coaching to achieve successful risk management [7]. An innovative way of risk factor management may be NP treatment with the aid of the Internet in addition to usual care.

Appealing language, visual attractive, accessibility and speed makes the Internet very attractive for patients to receive medical information. The patients can surf on the Internet according to their own needs. However, the large volume of information available on the World Wide Web makes it difficult for patients to select proper information that pertains to their particular needs. Many patients are interested in using e-mail to communicate with their physicians and in receiving online health information from their doctor's office [8]. Some analysts also predict that Internet-based programs will become the primary venue for remote patient management in the future [9].

There are studies that show that behaviour e-counseling for quitting smoking, losing weight, management of type 2 diabetes and drug compliance are more beneficial compared to a control group without the use of e-counseling [10-13]. Ross et al showed improved adherence and feasible access to an online medical record in patients with congestive heart failure but demonstrated no effect on health in a pilot-study [14]. To our knowledge, one study showed no favourable effects of a web-based nutrition counselling and social support for 146 patients with an increased cardiovascular risk [15].

In the Self-management of vascular Patients Activated by Internet and Nurses (SPAIN) pilot study, we want to implement and test a secure patient-specific website with additional treatment and coaching of a NP for several risk factors in patients with clinical manifestations of CVD. Patients with symptomatic cardiovascular disease have most often multiple risk factors and a combination of risk factors also increases the risk of vascular events. The aim of this pilot-study is to gain insight into feasibility of using the Internet for risk factor management.

2 Methods

2.1 Study Population

For the current study, patients are invited with clinical manifestations of atherosclerosis (coronary heart disease, cerebrovascular disease, abdominal aortic aneurysm, or peripheral arterial disease). These patients participated also in the Second Manifestations of ARTerial disease study (SMART), a single-centre prospective cohort to investigate the prevalence of additional vascular diseases in patients who already have a manifestation of arterial disease or who otherwise at a high risk to develop symptomatic arterial disease [16]. Before the start of the SPAIN-study, we investigated

the computer use and Internet access of 628 patients participating in the SMART-study. Four hundred ninety-nine (80%) patients completed the questionnaire. 324 respondents who indicated their unwillingness to participate were older (61 versus 55 years); were more often female (31% vs 18%) and these patients have more existing risk factors than the 175 respondents who were interested in participation. One quarter (175 of the 628) of the patients, who received a questionnaire, was interested in online patient-specific treatment and coaching by a NP. This demonstrates that the proposed intervention can appeal to a substantial number of patients. However, due to personal capacity, 50 out of 175 are randomly invited for participation in the SPAIN-study. Eligible patients with manifestations of atherosclerosis, aged 18-79 years, should have a computer and Internet access and being proficient in Dutch reading / writing. They will be invited to visit the University Medical Center Utrecht (UMC Utrecht) for baseline examinations. An extensive standardized questionnaire is filled in and blood is examined for presence of traditional risk factors. The Ethics Committee of our institution approved the study and written informed consent will be obtained from all participants.

2.2 Nurse Intervention

The anamnesis, physical measurements and results of the blood chemistry of patients are the starting point of the intervention. The patient will receive information about his / her elevated risk factor(s) and individualised realistic treatment goals based on current guidelines [2] will be discussed with the patient. The personal treatment goal(s) and appointment(s) how to reach the goal(s) will be set in five separate action plans for hypertension, hyperlipidemia, diabetes mellitus, obesity, and smoking. Also regular exercise, healthy diets, and adherence to medical treatment are part of the total intervention. Action plans should give patients confidence in managing their disease and fuels internal motivation [17] When the action plan(s) for each elevated risk factor are set, information about accessing and using the patient specific website will be given to the patient. The personal data, relevant medical information and the action plan(s) needed to achieve the treatment goal (s) are registered in the patient-specific website. The patient receives a personal login and password in order to communicate with the NP by e-mail via the website. The frequency of e-mail contact will be determined by the needs of the patient. It is for instance possible that a patient can enter his/ her own weight or a new blood pressure measurement, besides the regular exchange information with the responding NP through e-mail messages. The NP personally will reply as quickly as possible during working days and will give regular but protocol driven feedback, support, and recommendations to the patient in changing or maintaining the desired lifestyle and in their adherence to the prescribed medication.

2.3 Website

The SPAIN website contains a secure, password protected, web based application for both patients and NP. The application facilitates communication between patient and NP, the entry and storage of medication use and laboratory or physical data, the sharing of information like general news and relevant links to other websites and the use of reminders and past agreements. Data entered and created during the use of the application will be stored and available for further analysis. The application has been

developed in Visual C# .NET using Microsoft Visual Studio .NET. The back-end database is a Microsoft SQL Server database.

The patient-specific website contains a homepage "My SPAIN" and five separate pages for the following risk factors: hypertension, hyperlipidemia, diabetes mellitus, obesity, and smoking. The homepage contains current medication use, general news on atherosclerosis and five links to the risk factor pages. The links will be visualised using "traffic light" colours. Green corresponds with adequate level of the particular risk factor, orange with a dangerous zone for a risk factor, and red means a clearly elevated risk factor and treatment is necessary. The risk factor pages all have the same lay-out and functionality. They display tabular real-time laboratory or physical data, sent and received messages, facilities to describe the treatment appointments, and links to additional risk factor specific education facilities. The patient's entered data of a physical or laboratory measurement automatically receive a corresponding colour (red, orange, green) by which changes in positive or negative direction are visible.

The NP application offers the two above mentioned pages and an additional overview page with lists of all patients under treatment, date of last login, unread messages or entered laboratory or physical measurements, and a to-do list.

2.4 Primary Outcome Measure

The primary outcome is the implementation and the utility of an individualized tailored website for the patient and NP. After six months of Internet-communication with the NP, the participating patients (n=50) will be asked to visit the hospital again for follow-up measurements of the risk factors and to assess patient's specific beliefs and determinants of changing behaviour such as awareness, attitudes, social-influences, and self-efficacy via validated questionnaires.

The frequencies of logins of patients and NP, the amount of corresponding e-mail messages and the pre-post measurements of risk factors provide insight into feasibility and satisfaction. A randomized controlled trial is needed to examine the cost-effectiveness of this intervention compared to usual care.

References

1. Murray CJ, Lopez AD. Alternative projections of mortality and disability by cause 1990-2020: Global Burden of Disease Study. *Lancet* 1997; 349:1498-1504.
2. De Backer G, Ambrosioni E, Borch-Johnsen K et al. European guidelines on cardiovascular disease prevention in clinical practice. Third Joint Task Force of European and Other Societies on Cardiovascular Disease Prevention in Clinical Practice. *Eur Heart J* 2003; 24:1601-1610.
3. Erhardt LR. Barriers to effective implementation of guideline recommendations. *Am J Med* 2005; 118 Suppl 12A:36-41.
4. Campbell NC, Ritchie LD, Thain J. Secondary prevention in coronary heart disease: a randomised trial of nurse led clinics in primary care. *Heart* 1998; 80:447-452.
5. Jolly K, Bradley F, Sharp S et al. Randomised controlled trial of follow up care in general practice of patients with myocardial infarction and angina: final results of the Southampton heart integrated care project (SHIP). The SHIP Collaborative Group. *BMJ* 1999; 318:706-711.

6. Vale MJ, Jelinek MV, Best JD et al. Coaching patients On Achieving Cardiovascular Health (COACH): a multicenter randomized trial in patients with coronary heart disease. *Arch Intern Med* 2003; 163:2775-2783.
7. Sol BG, Van der Bijl JJ, Banga JD, Visseren FL. Vascular risk management through nurse-led self-management programs. *J Vasc Nurs* 2005; 23:20-24.
8. Ferguson T. Digital doctoring--opportunities and challenges in electronic patient-physician communication. *JAMA* 1998; 280:1361-1362.
9. Dakins DR. Home is where the healthcare is. *Telemed Today* 2002; 9:18-21.
10. Artinian NT, Harden JK, Kronenberg MW et al. Pilot study of a Web-based compliance monitoring device for patients with congestive heart failure. *Heart Lung* 2003; 32:226-233.
11. Meigs JB, Cagliero E, Dubey A et al. A controlled trial of web-based diabetes disease management: the MGH diabetes primary care improvement project. *Diabetes Care* 2003; 26:750-757.
12. Strecher VJ, Shiffman S, West R. Randomized controlled trial of a web-based computer-tailored smoking cessation program as a supplement to nicotine patch therapy. *Addiction* 2005; 100:682-688.
13. Tate DF, Jackvony EH, Wing RR. Effects of Internet behavioral counseling on weight loss in adults at risk for type 2 diabetes: a randomized trial. *JAMA* 2003; 289:1833-1836.
14. Ross SE, Moore LA, Earnest MA, Wittevrongel L, Lin CT. Providing a web-based online medical record with electronic communication capabilities to patients with congestive heart failure: randomized trial. *J Med Internet Res* 2004; 6:e12.
15. Verheijden M, Bakx JC, Akkermans R et al. Web-based targeted nutrition counselling and social support for patients at increased cardiovascular risk in general practice: randomized controlled trial. *J Med Internet Res* 2004; 6:e44.
16. Simons PC, Algra A, van de Laak MF, Grobbee DE, van der Graaf Y. Second manifestations of ARTerial disease (SMART) study: rationale and design. *Eur J Epidemiol* 1999; 15:773-781.
17. Bodenheimer T, Lorig K, Holman H, Grumbach K. Patient self-management of chronic disease in primary care. *JAMA* 2002; 288:2469-2475.

Visualizing Energy Consumption of Radiators

Magnus Gyllensward, Anton Gustafsson, and Magnus Bang

Interactive Institute, SE-632 20 Eskilstuna, Sweden
{anton.gustafsson, magba}@tii.se

Abstract. Heating is a significant expenditure of many households today but the actual power consumption of the heating devices are seldom recognized. To help people understand and reflect upon their domestic energy consumption, we have designed an electrical radiator that emits heat entirely from light bulbs. This appliance responds to temperature changes in the room via sensors. The idea was to combine the product semantics of lamps and radiators and direct focus on the latter neglected product category. We argue that by re-designing domestic appliances adding means to visualize energy consumption in engaging and interesting ways it is possible to make energy utilization less abstract and easier to comprehend.

1 Introduction

In domestic environments, we seldom recognize that appliances are consuming electrical energy. Since the home appliances do not communicate their consumption behaviour it becomes difficult to understand and make rational decisions about energy-related issues.

We believe that by visualising the energy consumption of various devices, consumers can learn when and how the devices consume electricity and be encouraged to save energy [1,2]. Direct feedback, for example, could help consumers build conceptual models of how energy-consuming devices behave in different situations making the perception of electricity less abstract [1].

Researchers and artists have created artefacts that visualise and draw attention to energy and heating in various ways [3]. Our work is – in its form – related to the art of Höller [4] and Veilhan [5]. Both these artists are using light bulbs as building blocks in their pieces. For example, Veilhan created the Big Light Machine, a screen by acting pixels that merge visuals with heat experiences [ibid.]. However, their work are not intended to direct the viewers' attention to the energy consumption of the object per se.

The overall aim of our research is to explore new designs for energy awareness and clarify the abstract phenomenon of electricity. In this paper, we present an alternative radiator and information display, designed to raise awareness, visualise and make a statement on the invisible energy consumption in the home. We discuss the design concept and the results from a user study.

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 167 – 170, 2006.

2 Rationale

Verbeek and Kockelkoren discuss *engaging objects* [6]. These are attractive artefacts in terms of form and interaction and the appealing properties are designed so that users become *involved and learn* from them. Following Heidegger, the idea is to move underlying operations of objects to a visible level and make users part of the functional processes. These authors discuss typical engaging object such as a heating device developed at the Cranbrook Academy of Arts. This device can direct its output spatially and allow people to interact with heat. This means that users can actively and playfully reflect on its function and the environment that it aims to control.

Our work is also inspired by augmented reality designs where the aim is to superimpose information directly onto the physical world such as the Heatsink [7]. The Heatsink was developed at the MIT Media Lab and it incorporates red or blue colour information (light) in ordinary tap water depending on its temperature. We believe that engaging objects generally have good persuasive powers – due to the reflective learning process that they support – and this has been one of the starting points in our work with radiators.

Lights and lamps have a very central and personal role in the Swedish home. Radiators, on the other hand, are seen as solely functional objects and they are placed out of the way in the home. Typically, people buy the most inexpensive and efficient ones. In other words, lamps are more in the centre of attention in the Swedish home than products like radiators. This is fairly self-evident, but from a use-of-energy point of view it should be the other way around, because radiators consume much more energy than lamps and they should preferably communicate this.

3 The Element

The Element was constructed from 35 light bulbs that were attached in a metal frame between two panes of tempered glass. 60-watt lamps were chosen to obtain the same heating effect as a conventional electrical radiator (approximately 2000 watts). The casing contains control electronics and a set of internal and external heat sensors – attached via a cord – and they determine the temperature. A dimmer circuit connected to a microprocessor controls the intensity of the lamps. A control wheel is placed on the right side and it is used for temperature settings and this value can be seen on a display on the top of the casing. Figure 1 shows the Element.

When the appliance is turned on, it will slowly start to glow increasingly brighter and the temperature in the room will rise to the value of the control wheel. If the temperature in the room suddenly drops or the control wheel is altered to raise the temperature even more, the Element attempts to balance this by emitting more light. The external heat sensor does not only portray the immediate thermal climate near the radiator, but also disclose the climate of the entire room. For example, when the external sensor pick up a small change in temperature the light bulbs signal this information immediately as they try to compensate for this. The climate in the room is in this way portrayed and the users can see the consequences of various activities such as opening the windows.

Fig. 1. The Element

4 User Interviews

We presented the prototype to ten individuals to collect user feedback in a semi-structured interview approach [8]. The aim was to let users explore the prototype and discuss their experiences [9]. The group consisted of students between ages 20 to 29.

In the first part, each person was shown the prototype and encouraged to explore it. We did not provide explanations letting users create their own interpretations of the object. To investigate the results of the blurred product semantics, we wanted to find out if the participants could understand the relation between the control wheel setting and the light, that is, see it as a radiator. Moreover, we were interested in the emotions the artifact imposed on the subjects to determine if it was seen as an engaging object.

However, very few saw it as a radiator when they turned the control wheel. People usually started with the assumption that it was connected to the intensity of the light like an ordinary dimmer. When proven wrong whilst turning the knob, most participants suggested that it was a temporal light control and that it was a delay. Apparently, the connection between heat and light is not a very clear one, at least not when interacting with light bulbs. In some cases, we also showed an ordinary radiator before we presented the prototype and they still failed to recognize it as a radiator.

This is possibly an indication of how strong the product semantics of light bulbs are. A common remark in our sessions was “I don’t think it’s just a lamp”. In other words; a lamp was their first association. However this was often quickly ruled out probably due to the placement of the bulbs or the form of the casing. Naturally, possible bias situations are difficult to rule out in experimental designs such as these.

During the second part of the evaluation, we were interested in what kind of information the object conveyed. Specifically, how the subjects related it to external factors that influence power consumption, heat, and light. That is, what kind of energy information the test persons would be able to gain from the prototype and their general understanding of the functionality of the radiator. The subjects were asked to rate the Element in relation to other electric devices in terms of its energy consumption. Subsequently, an ordinary radiator was shown to them and we asked

questions regarding the relationships between the two. Finally, a brief explanation of the Element was given followed by some concluding questions on how they would use it in their homes and what kind of benefits they saw.

Some participants said it would be useful as an indicator of changes in the domestic climate such as open windows and function as a reminder of it being on or off. The information given by the Element was also seen as something that could provide a more environmentally sustainable way of thinking about energy because it visualizes the actual consumption. Moreover, almost all participants found the Element aesthetically pleasing and were intrigued and fascinated by it.

5 Conclusion

In this paper, we have presented a concept and prototype for an electrical radiator that visualizes energy and emits heat entirely from light bulbs. The aim was to blur the product semantics of lamps and radiators to create an engaging object that disclose hidden properties of heat and energy. Users found the ambient display to be an intriguing and interesting way to present energy consumption. To conclude, engaging objects such as our Element can influence users to reflect on energy and render such intangible phenomena more understandable.

References

1. Jensen, O.: Visualisation turns down energy demand. Proceedings from the ECEEE 2003 Summer Study, Saint Raphael, France (2003) 451-454
2. Matsukawa, I., The Effects of Information on Residential Demand for Electricity. The Energy Journal, Vol. 25, No. 1 (2004) 1-17
3. Laarman, J.: The Decorative Radiator. Droog Design (2004) http://www.droogdesign.nl/
4. Höller, C.: Light Wall, Schipper & Krome, Berlin (2001) http://www.airdeparis.com/holler.htm
5. Veilhan, X: The Big Light Machine [Grande Machine Lumineuse] (2004) http://www.veilhan.net/
6. Verbeek, P.P., Kockelkoren, P: The Things that Matter. Design Issues 14 (1998) 28-42
7. Bonanni, L., Arroyo E., Chia-Shun Lee, J., Selker, T: Exploring Feedback and persuasive technology at the sink. Interactions 12 (2005) 25-28.
8. Kvale, S. InterViews: An Introduction to Qualitative Research Interviewing. Sage Publications (1996)
9. Buchenau M., Suri J.: Experience Prototyping. Proceedings on the conference on Designing interactive systems: processes, practices, methods, and techniques. ACM Press, New York (2000) 424-433

Captology: A Critical Review

Bernardine M.C. Atkinson

School for Environmental Research, Institute of Advanced Studies,
Charles Darwin University,
Darwin, Northern Territory 0909, Australia

Abstract. This critical review of B.J. Fogg's book Persuasive Technology regards captology as an eclectic and formative work. It summarises two other reviewers' work and identifies several new strengths. It scrutinises Fogg's functional triad - computers functioning as tools, media and social actors - and some categorical changes are recommended. It investigates further Johnson's concerns about specific ethical omissions, nominating a new term, compusuasion, for the resultant but unintended, exogenous behaviour/attitude change effects of captological design. The review commences to more carefully define what constitutes persuasion and draws attention to the distinction between persuasion techniques in general and the behavioural changes that result from advocacy and education. The reviewer concludes that a fundamental ethic be that the designer's intent be exposed at the commencement of the user's engagement with the program and proffers the idea of persuasion resulting in a new conviction, induced by others, as a helpful definition of persuasion.

1 Introduction: Overview of the Strengths and Weaknesses of Fogg's Analysis

In 2003, B.J. Fogg published a book, Persuasive Computing: Using Computers to Change What We Think and Do [1], it is a book which bravely brings the association between computers and persuasion to topical debate. There are two recent reviews of this book. The review by Robert Johnson [2] highlights several shortcomings. In particular, captology presented several areas of ethical concern for Johnson, notably the work's design focus. Johnson says that while 'the book portends to be interested in end users – office workers, teachers, students (young and old), and the general public - … in practice, the book is designer-centred and system-centred'. Hence, the omission of significant user-testing and user-input into the development and refinement of captological design is regarded as a serious oversight by Johnson. Such an omission is not at all in keeping with current user-centred, useability-design philosophy. Furthermore, Johnson observes that because, as Fogg writes, 'Captology does not include unintended consequences: it focuses on the attitudes and behaviour changes intended by the designers of interactive technology products' [2], an ethical design impasse is created. Responsible, user-centred design necessitates a sound examination of both the intended and unintended consequences of the technology and this is, in part, assessed by the useability testing procedure that is now

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 171 – 182, 2006.

almost mandatory for information technology designers (theoretically derived from Suchman's [3] interpretation of Heidegger's work).

In a kinder appraisal of the book, Anastasis Petrou [4] thought that the ethical problems persuasive computing confronts had been adequately addressed by Fogg and she highlighted some of the work's particular strengths, for example, the seven types of persuasion technique particularly suited to the computer medium (p1169 of [4]). In brief, they are: reduction, tunnelling, tailoring, suggestion, self-monitoring, surveillance and conditioning.

My own review of Persuasive Technology: Using Computers to Change What We think and Do, shows that Fogg's ethical reminders are at this point in time, 'short reminders' (Petrou's words), and not soundly, philosophically and theoretically, incorporated into his discourse. This omission, in part, probably stems from the seminal status of the work and its presentation to date as an essentially eclectic compilation, garnering all ideas closely and remotely related to the topic of 'computers and persuasion'. For example, omitted is the essential definition of what actually constitutes persuasion and a sound analysis, in a more rigidly-defined context, of what constitutes an ethical application of 'persuasion' principles. Even more importantly, one specific generic definitional concern relates to the language used prolifically throughout the text, a text that lazily attributes an autonomous subjective status to computers as agents of persuasion. Computers per se are not subjects, they are objects. They cannot of their own volition persuade: they are machines that perform their designers' intent. The acronym, captology, 'computers as persuasive technology', is in fact nonsensical and is indicative of a trend many information technology writers adopt: anthropomorphising their machines. Lexicologically, it is more appropriate to study the relation between computing and persuasion as 'computer-mediated persuasion'. Fogg dismisses the idea of categorising 'captology' as such, as a matter of being relegated to an incorrect discipline - computer-mediated communication, CMC - preferring to relegate it to the domain of human-computer interaction, HCI (p16 of [1]). Both design endeavours overlap significantly, but correct definitional assignation requires an examination of fundamental lexical definitions, and should not be confused with the naming of various disciplines or schools of thought.

However, there are appealing and redeeming aspects to Fogg's compilation: these include the many examples of what I prefer to call 'enhanced useability' evidenced by Fogg's guiding research strategy that asserts 'you can create more likable and persuasive interactive technology by leveraging principles from social psychology'. These principles include: the use of praise; the creation of strategies to enhance a sense of affiliation and similarity; simulating personality traits; and, among others, harnessing the principle of reciprocity (see Fogg's Chapter five [1]).

Fogg's review of the potential influence of 'simulations' is enlightening and he demonstrates where:

Simulated environments can persuade through creating situations that reward and motivate people for a target behaviour; allow users to practice a target behaviour; control exposure to new or frightening situations; facilitate roleplaying, adopting another person's perspective (p63 in [1]).

There is also a wonderful list of factors that contribute to site credibility (p147 – 181 of [1]). Another strength that both reviewers noted is Fogg's 'functional triad' which they see as being a useful conceptual design tool. However, on close examination, the triad, as it now stands, seems to incorporate several 'categorical' or definitional errors and so, at this stage, the idea does not stand up to close theoretical scrutiny.

2 The Functional Triad

Fogg describes the *'functional triad'* as follows:

The functional triad shows that interactive technologies can operate in three basic ways: ***as tools, as media, and as social actors.*** *These three functions capture how people use or respond to virtually any computing product,…*

In their role as tools, the goal of computing products is to make activities easier or more efficient to do. …

There are two categories of computers ***as media****: symbolic and sensory. Computers function as symbolic media when they use symbols to convey information (for example, text, graphics, charts, and icons). They function as sensory media when they provide sensory information – audio, video, and (rarely) even smell and touch sensations. … While both symbolic and sensory media can influence people, captology focuses primarily on computers functioning as sensory media – especially computer simulations – because in this role, computers have unique capabilities to provide interactive experiences that motivate and persuade. …*

The third corner of the triad depicts ***the role that computers play as social actors or living entities.*** *When people use an interactive technology, they often respond to it as though it were a living being* (p 25 – 27 of [1]).

2.1 Tools

There is some confusion, notably in the invention of the idea of a 'functional triad', about whether captology is the 'tool' of users or designers. Clarifying the subject of captological endeavours will be important to avoid the ambiguity of meaning that surfaces in Fogg's work. Does a computer function as a persuasive 'tool'? If the tool is something we use to achieve an objective we have previously independently established, does the user's application mediate persuasion? The answer is 'no'. For captological purposes, to facilitate persuasion, the computer is the tool of the designer, not the tool of the user. The computer is the mechanism for conveying, or mediating, its designers' intent. If the user chooses to follow a program and chooses to adopt its semiotic proffering to achieve a desired new behaviour, value or attitude, then the program may be called a user's tool.

2.2 Medium

A categorical error happens with the use of the category 'medium/media' as one of the triad's functional elements. Consider this: in all functions the computer operates as a medium, using various forms of media to convey its designer's purposeful information.

Medium, by definition is 'the means by which something is communicated', or 'the intervening substance through which impressions are conveyed to the senses' [5]. To aid any 'tool-like' operations (for example, a calculator) visual, textual, audio qualities and numerical symbols can all be used. To create a simulated social presence various media are harnessed. If Fogg's definitional use of the term '*medium/media*' relates primarily to '*computer simulations*' which involve the use of life-like scenarios '*to create a compelling experience to persuade people to change their attitudes or behaviours*', then the functional persuasive element is not the 'medium' or the media, but the 'compelling' simulated experience. Fogg proposes three types of simulation: '*simulated cause and effect scenarios; 'simulated environments*'; and '*simulated objects*'. These 'simulations', I believe, more accurately suit the definitional purpose proposed for the '*medium*' element of captology's '*functional triad*' (p61 – 89 of [1]).

However, a further quandary is introduced by saying persuasion has happened and has been effective through the use of the Fogg's functional triad, and in particular, simulations. Does the drink-driving simulator 'persuade' its users to avoid drink driving (p79 – 81 of [1]) or rather, does it educate about the hazards associated with driving under the influence of alcohol and so create a greater awareness? The fact that one is knowingly participating in such an exercise suggests that persuasion is less of a force than is general curiosity, enquiry or self-education, or even 'window-shopping'. Fogg (p147 of [1]) also writes: '…you'll see that many sites seek to persuade users in some way …'. But this could be rewritten as 'many sites offer a service or proffer goods for sale'. Persuasion is more powerful than a mere proffering: it seeks to convince people to adopt new ideas and behaviours. Should we equate people's browsing (which indicates that they are keen to explore and experiment) with that they are being persuaded? Should we equate curiosity, the thirst for new knowledge and experience, as a function of persuasion? No. People engaged in these activities are not necessarily being swayed from their own convictions, rather, they are enriching their conceptual schemata of the world.

2.3 Social Actors

The triad's third functional element, 'social actors', also presents categorical and definitional challenges. Fogg's preliminary work tells us that:

…as social actors computers can persuade people to change their attitudes or behaviour (p27 of [1]). My own research … confirms that people respond to computer systems as though the computers were social entities that used principles of motivation and influence (p90 of [1])…at times people do respond to computers as though they were living beings. (p89 of [1]).

In my opinion, these observations and conclusions involve a false assumption. That we respond to computers in such a fashion is more probably a result of us being human, socially gregarious beings who do not possess 'synthetic' non-social communicative alternatives, rather than to have actually incorporated a belief that the machine is in fact a real social actor. It is eminently probable that we would respond similarly to any object that replicated our human social mannerisms. We, being human and social creatures, have no real choice in the matter; we have no inherent mechanical mode of communication (unless we imitate mechanistic objects themselves, in a manner similar

to the lyrebird's 'chainsaw, trail bike and waterfall' warbles). However, we can create lexical and logical solutions by inventing new words to describe mechanistic, artificial phenomena in non-social language:

macrosuasion, microsuasion, captology and *compusuasion* (defined later) are examples of such.

The social actor category also presents a definitional error. How we use the language is incredibly important. We agree on shared meanings (called definitions) and a great many constructive communication precedents follow. If these inherited, carefully defined meanings are changed, all of the established conventions associated with the original definition are challenged and logic and truth can suffer. Correct extrapolations follow correct theory. The same applies to definitions: if we can provide a new body of work with correct fundamental definitions, the consequent applications, categorisations and conclusions will be logical, with all of logic's commensurate benefits of prediction, inference, deduction, reduction, induction, adduction and so forth. If the basic terms involve contradictions or convey unintended meanings, then confusion will result from the subsequent application of these terms.

We humans are social creatures; computers are machines. Excluding the hermit, we cannot exist in isolation from each other, but even the hermit's isolation is only apparent in relation to the absence of the people he or she excludes. If the machine has the function of simulated social presence incorporated into its design, then the term should be hyphenated, i.e. social-actor. This conveys a slightly different meaning to what we know to be a human-only designation, a social actor. It means that the social is feigned and so may be more appropriate in the context Fogg intends. But, to my mind social-actor is still inadequate: an actor is a man, so social-simulation is a better.

This category also involves a semantic error. Machines are not 'socializable' because they are not social creatures; they are not fellow human beings. In the words of Dr Mitroy (pers.comm. 2006) 'The computer does not exhibit the entire range of responses exhibited by humans acting under free will'. That a computer can be designed to recognize aspects of the surrounding environment and monitor its own mechanistic processes are man-made, imitative functions and mechanistic phenomena. To infer 'personality' is an incorrect inference. That it exists is a contrivance. Fogg's application of principles learnt from social psychology fall prey to this error. For example,

If something is physically attractive, people tend to assume they also have a host of admirable qualities such as intelligence and honesty'; and, 'physically attractive computing products are potentially more persuasive than unattractive products'; … 'if an interface, device or onscreen character is physically attractive… it may benefit from the halo effect; users may assume the product is also intelligent, capable, reliable, and credible' (p 90, 93, 94 in [1]).

Fogg says that social presence can also be derived from simple dialogue boxes without any onscreen characters, voices or artificial intelligence. These sort of 'cues' are derived from an extrapolation of the results of research to understand human traits and then simulating these traits to create a sympathetic human/machine dynamic. But the search for the enhancement of social cues that exacerbate and strengthen our innate tendency to make the inference of 'sociality' in computers rings alarm bells.

These 'social cues' are features normally associated with living creatures: physical features like faces, eyes, voices and voice tonality and the type of language employed; social dynamics, like taking turns offering praise or answering questions; adopting roles such as that of an advisor, doctor, friend, and so forth (p90 of [1]). Using this concept of social actor uncritically, if we are not careful, will perpetuate an illusion, compound Baudrillard's [6] Procession of the Simulacra and cause us to fall victim to Rene Dubos' [7] warning that humans continue to adapt to maladaptive situations.

There are many dangers associated with being beguiled into believing we are interacting with genuine personality. But do we interact with computers, do we interact through them or do we simply use them? Fogg (p16 of [1]) says that 'the computing product is a participant in the interaction'. I beg to differ.

3 Machines and Social Presence

This sort of rationality and the lexical legitimisation of a social presence, when it is only simulated, is sometimes attributed to Orr's [8] ethnographic study of the way computer technicians work with their machines and converse about them amongst themselves. It is a study which, in turn, cites Bruno Latour's early assertions ([9] & [10] in [8]) that machines participate in society. The summary introduction to Orr's book tells us that: '*machines are a social presence through their participation in this social world', and, 'The social interaction happens, in some sense, and happen in the way they happen because the machines need to have technical things done to them. The technicians have the ability to do those things and the rest of the relationship follows from the contact between the customer's need and the technician's ability'* (p3 of [8]).

Orr himself quotes several authorities that support this perspective, including Latour:

Latour tells us that machines prescribe human behaviour, forcing us to do certain things to use the machines or other things to accomplish our ends without using the machines. This is part of his argument that machines participate in human society to such an extent that neither technology nor society can truly be considered apart from the other (p 105 of [8]).

But it is our engagement with the machine, not the machine's engagement with us, that gives the semblance of sociality. The relationship is not one of equals, it is a utilitarian association, the computer is our machine, it is like a mobile library, we engage it for its functional purposes. It is not capable of independently instigating a genuine relationship, nor any relationship, without other human beings providing it with that simulated capacity. It is odd that Orr's ethnography (in particular the summary introduction) is attributed and credited with promulgating this type of semantic rationalisation when he also presents the following principles which fairly and squarely replace the interactive initiative with humans, not computers. Such a thought is, I believe, a more correct representation of his own, considered perspective represented in more depth in the body of the work:

The machines never participate with intent…. Machines represent the intent of their designers and so are an extension of human interaction with humans. Furthermore, intentions and their results must be considered in their social settings;

the machines must be seen simultaneously as products of the social context of their design and production and as participants ***in the goals of their users*** (p 105 of [8]).

Weizenbaum's [11] horror at discovering that inexperienced computer users actually accredited the program Eliza with independent personality and intelligence shows that this mistake is still possible, but, I believe, less likely today when most users are more familiar with the machines' internal workings and aware that they are interacting with designers' programs. However, if we allow this lexical duping to continue, we may indeed be tempted to say that computers do persuade us. But humans deserve better than to be duped.

4 Persuasion and Compusuasion

If we agree that some computer products and programs can mediate 'persuasion' (and to establish this clearly, a new conviction or behaviour, that intended by the designer, would have to have happened: this would be a good measure of whether one had been 'persuaded') Fogg has coined some appropriate terms for the composite elements of computer-mediated persuasion (which we should always clearly distinguish from education and self-education): *macrosuasion* (p17 of [1]) which Fogg used to describe the overall persuasive [designers'] intent of the product, in other words, the specific behavioural or attitudinal change intended by the designers; and *microsuasion* (p19 of [1]) which incorporates smaller persuasive techniques to achieve the macro-goal (such as the rewards used to help users stay on a site, or with a task, longer). It is my understanding that *microsuasion* techniques could be regarded as similar to those persuasive elements used by rhetoricians and mastered in sophism (such as the appeal to emotion, repetition, association and band-wagoning). The ethical omission, that which ignores exploring unintended changes in attitudes inherently associated with or caused by the product, is both a theoretical and a design oversight. It is true that unpredicted, unforeseen and unintended consequences categorically do not belong with having been persuaded, because genuine persuasion results in the adoption the new behaviour intended by the designer. But if the program results in unforeseen, induced behavioural changes, it is appropriate for the discipline to assume responsibility and to name such phenomena. I nominate '*compusuasion*' as an appropriate term.

5 Can We Plan for New Technologies?

That a modern exploration of new computing potential can omit an assessment of what might be the 'exogenous and unintended impacts' of a technology specifically designed to influence people's behaviour is representative of a far more comprehensive problem for society at large. Axup [12] says the lack of planning associated with comprehending and predicting the behavioural influences of many new technologies (including: those derived from innovative architecture; Napster – an easy-to-use software program – which enables 'the easy exchange of music files via the internet [and] results in large amounts of stealing'; mobile phones; the news genre; many kinds of drugs; transportation; television; and the internet), is common.

Axup notes, in particular, the role zestful (largely unscrutinised?) marketing strategies have played in accelerating the distribution and adoption of such technologies. But he is more concerned with technology that is created 'with the specific aim of altering social behaviour of a target group of users in a particular way (which) could be considered 'social engineering', particularly 'persuasive computing' and 'affective technology'… Moral and ethical issues rapidly come to mind as one considers the idea of technology being used to influence people's behaviour. Whether it happens consciously or unconsciously really isn't the issue, although the latter might be more dangerous. In either case, society is affected. … And yet, in retrospect, it seems like there should be ways to predict that the telephone would revolutionise the entire world and that the introduction of automobiles would have environmental effects. Some level of accurate prediction must be possible' [12].

Accordingly, Axup proposes an 'impact statement' for new technologies. But such a statement, specifically designed to predict and thwart deleterious exogenous effects, encroaches on what we know to be the domain of the 'wicked-problem' and the difficulties associated with such prediction-based assessments are numerous as Rittel's [13] wicked-problem thesis showed.

Rittell observed that policy planning's systems analysis had evolved from the examination of questions like '*what are they made of*' to '*what do the systems do*' to '*what should the systems do*', leading him to conclude that such analysis involves confronting 'wicked-problems' whose resolution, Rittel suggests, '*rely upon elusive political judgements*'.

Rittel describes the wicked-problem as being characterised by at least ten distinctive properties evidencing some of the following phenomena:

- *'no ends to the causal chains';*
- *'that in order to describe a wicked-problem in sufficient detail, one has to have developed an exhaustive inventory of all conceivable solutions';*
- *'solutions to wicked-problems are not true or false, but good or bad';*
- *'…any solution, after being implemented, will generate waves of consequences over an extended, virtually unbounded, period of time';*
- *'every implemented solution is consequential…large public works are effectively irreversible, and the consequences they generate have long half-lives';*
- *'despite seeming similarities among wicked-problems, one can never be certain that the particulars of a problem do not override its commonalities with other problems already dealt with';*
- *'marginal improvements do not guarantee overall improvement';*
- that those who address wicked problems are *'planners (are) liable for the consequences of the actions they generate'*: planners do not have the luxury of the solution proffered being *'only a hypothesis for refutation (Karl Popper)'*.

Rittel was concerned that we have no definitive theory to help us determine a '*societally best state*' which, in turn, could serve as a guide for us to assess the futuristic impact of new developments and policies (p38 of [13]). Rittel painted a bleak outlook, but his description of the 'wicked problem' and his recognition of the complex, consequential nature of progressive and remedial societal initiatives remains useful, although his was seemingly a worldview bereft of familiarity with ethical

philosophy. To harness all of the strategies he mentions (like entrusting *de facto* decision-making to the wisest, most knowledgeable professional experts and politicians, and biasing decisions towards utilitarian outcomes) would be regarded as responsible action today. We have also learnt from 'wicked' consequences, such as his aforementioned considerations, that it is appropriate for the scientists, the politicians and those who will be affected by the technology to come together beforehand to exercise collective '*judgement*' about which '*solutions should be pursued and implemented*'. Such an, albeit unwieldy, combination of people provides a more comprehensive analysis of the potential effects of new technology.

Where we now genuinely harness public consultation, exercise adaptive management, facilitate social learning and apply multi-stakeholder negotiation (B. Campbell, *pers. comm.* 2005), we find we can reduce the unintended and unforseen consequences of social planning. We can also constructively use hypothetical scenarios and personas to help anticipate likely developments, but sometimes neglected is an older and often reliable method of assessment: that is, to gauge impact by current established philosophical, ethical, moral and human rights principles. These guiding principles reflect the pinnacle of a society or culture's collective and responsible wisdom. This knowledge is the value of learning offered by schools of ethical and philosophic enquiry (now often abandoned by universities succumbing to economic rationalism). Where we may not be able to accurately predict the future we can learn much by applying principles established by ages-old hindsight. It is at this juncture that a more comprehensive ethical foundation could be considered.

6 The Ethics of Persuasion

Ethical principles can be defined as right and responsible action. Philosophical, theoretical, ethical frameworks and established moral codes provide us with guides to minimise harmful consequences. And while Axup, Johnson and many others, mention their concern about the ethical challenges presented by new computing developments, I am concerned that the reliance on '*the axioms of* [post modern] *individualism*' (which can induce the sense of doubt and uncertainty about ethical rectitude) leads us, through logical extension of relativism's fundamental premises, towards Nihilism: a nihilism which necessarily includes the rejection of moral principles and embraces the extreme scepticism that nothing in the world has a real and objective existence: it is all subjective. Post-modernism's subjective individualism was popular, easy to digest rhetoric, but a study of ethical and moral principles and emergent human rights can take us beyond the nihilistic entrapment of subjective individualism [14]. Fogg's book, while touching on ethical issues, leaves room for further consideration: we are left with the huge philosophical question, is computer-mediated persuasion ethical? Is it ethical to intend to change a person's attitude, belief or behaviour? It is ethical only if they are aware of the intention from the outset of their participation with the program. Anything that occludes this function is a form of manipulation which in turn can lead to coercion and be associated with propaganda and information that seeks to thwart and distort individual autonomy and even sound reasoning. This assertion is based on Hart's natural right theory that if human's have one fundamental inalienable right, it is their right to freedom [15], specifically freedom of choice. Such freedom

allows us to individually and collectively (through insights gleaned from others) resolve cognitive dissonance and helps create personal autonomy.

Persuasion that operates without the user being aware of the programmers' intent, it could be argued, might be ethical if the change in attitude, behaviour or belief is motivated from the perspective of wisdom, benevolence and genuine care for others. But would not this sort of benevolent intent be better constructed and represented by the sound reasoning we know as advocacy or even education, where intent is exposed at the outset or revealed through simple inquiry about course content? Advocacy, in mass media terms, differs from propaganda in that it implores a right way, a better way of acting [16]; education draws upon the body of truthful and established, peerreviewed fact. Exposure to both is cognitively enriching and can result in attitude, belief and behavioural change, but both remain respectful of the individual's own ability to synthesise the offerings provided by new information into a worldview that is meaningful for that individual. If they do not, we decry the resultant impact as 'brainwashing'. Convictions that arise from misinformation we call 'propaganda' and such misinformation can result in prejudice, intolerance and stereotypical judgements. We can distinguish the behavioural changes that result from advocacy and educational endeavours from the persuasion efforts of brainwashing and propaganda because advocacy and education are respectful of primary moral criteria that can be missing from a simple exercise in the techniques of persuasion: justice (in the sense of respect for all persons); veracity, in the sense of established fact; and truth, in the sense of personal honesty. These distinctions are important to our exploration of how to maximise the beneficial effects of our engagement with computerised, multi-media technology.

My own conclusion is that captology requires an immediate ethical safeguard and this could be fulfilled if the purpose of the 'persuasion', the *macrosuasion's* intent, was exposed at the beginning of one's engagement with a program. It would then be possible for the user to determine the program's relevance and exercise their right to accept or reject its offering. In Australia, this little hurdle has been overcome in the print media by the inclusion of the clause 'Advertisement only' and similar clauses could be devised to inform the user of the captological intent of the program or simulation. This is the true purpose of ethical and philosophical enquiry: to devise appropriate guiding principles.

7 Defining Persuasion

It is useful for an academic text, such as Fogg's offering, to distinguish very clearly between persuasion and education (and self-education). Education involves imparting established factual information and theory to its participants. We do not call the sharing of this information 'persuasion'. Self-directed enquiry is not persuasion. Persuasion is associated with rhetoric, a singular perspective that might or might not be correct, which the disseminator wishes his audience to adopt as their own. The techniques of rhetoric are the effective persuasive elements, some of which may help to circumvent rational thinking.

At the most primary level of involvement, if one turns on the machine, one is choosing to interact. Does not this act preclude the machine from the domain of

persuasion? It is important to note that if we personally seek information to help expand our own worldview or achieve a pre-determined goal, then our exercise of that choice does not constitute us being persuaded by another: we have chosen this course of action of our own volition. Without having made this distinction, the lack of sound definition relating to what constitutes persuasion results in, I believe, incorrect categorisations and confusion.

Fogg tells us that 'persuasion scholars don't agree on a single definition of persuasion' and that he defines persuasion as 'an attempt to change attitudes or behaviours or both'. But, if the attempt has not succeeded, we will not have been persuaded.

A strict dictionary definition tells us that persuasion embodies ideas like: To cause another person or one's self to believe; convince, induce' and sometimes 'lure, attract, entice' [5]. I think some confusion is caused by the inclusion of the phrase 'to cause one's self". Does one persuade one's self? If one does, surely one is responding to a predetermined, self-directed goal - some thought already present in one's conceptual, cognitive structure - and is doing something one has already determined will be of benefit? This sort of action is then not representative of the required change in belief or attitude induced by another to achieve this other's particular behavioural- or attitude-modification goal. So, to persuade involves specific intent from an outside agent to cause a specific, new or previously untenable belief, attitude or behaviour to be incorporated into the recipient's cognitive structure. It involves the targeted person adopting a new direction, one that is foreign to their own conceptual framework and behavioural repertoire. Nilsen [17] defines persuasion as 'the inducement in others of belief or action'. I am happier with this definition. Effective persuasion results in a change to a person's behaviour, attitudes or beliefs through the influence of another. What seems to be of great significance in this idea is the intent to cause a particular and specific, predetermined and previously untenable change, and that it comes from someone else's conceptual framework.

8 Conclusion

Captology is an exciting concept. It has seemed important to scrutinise captology in its formative stages to ensure that its future application will result in benefits to humanity. It is possible that captology's microsuasion principles could be harnessed to create interactive sites that serve to help humanity achieve the realisation of concepts like the ecological imperative: to become whole (in the old-English sense of a 'hale' human being), to create wholesome communities and to rehabilitate and restore ecosystems to their self-perpetuating and evolving state of continually enriched biodiversity [16 & 18]. At this point in human history, the restoration of the biosphere requires a commitment that goes well beyond the reach of governments and non-government agencies and to paraphrase the words of Wilbur Schramm, the attributed founder of mass communication theory, how fortuitous that in our hour of greatest need we have the communication potential to help us tackle successfully the enormous challenges before us.

References

1. Fogg, B. J. Persuasive Technology: Using Computers to Change What We Think and Do. San Francisco, CA. (2003)
2. Johnson, R. R. Book Reviews: Persuasive Technology. JBTC, Journal of Business and Technical Communication, April: 251 – 254 (2004).
3. Suchman, L. A. Plans and Situated Actions: The Problem of Human Machine Communication. New York, Port Chester, Melbourne and Sydney, Cambridge University Press (1987).
4. Petrou, A. D. (2003). "Book Review: Persuasive Technology." Journal of the American Society for Information Science and Technology (October): 1168 – 1170 (2003).
5. The Australian Oxford Dictionary. South Melbourne, Oxford University Press, (1999).
6. Baudrillard, J. The Procession of the Simulacra. New York, Semiotext (1983).
7. Dubos, R. Man Adapting. New Haven, Yale University (1965).
8. Orr, J. E. Talking About Machines: An Ethnography of a Modern Job. Ithica and London, ILR Press, Cornell University (1996).
9. Latour, B. How to Write 'The Prince' for Machines as Well as for Machinations. Technology and Social Change (1986), Edinburgh in Orr, J. E. Talking About Machines: An Ethnography of a Modern Job. Ithica and London, ILR Press, Cornell University (1996).
10. Latour, B. "Sociology of a Door." Social Problems 35(3): 298 - 310 (1988) in Orr, J. E. Talking About Machines: An Ethnography of a Modern Job. Ithica and London, ILR Press, Cornell University (1996).
11. Wiezenbaum, J. Computer Power and Human Reasoning: From Judgment to Calculation. New York, W.H. Freeman and Company (1976).
12. Axup, J. How to manipulate social behaviour (and why you'd want to) (2002). Tech Opinion, UserDesign.com. (2004).
13. Rittel, H. W. J. "Dilemmas in a general theory of planning." Reprinted from Policy Sciences 4(2): 31 - 39 (1974).
14. Atkinson, B.M.C (work in progress) Overcoming two philosophical hurdles for communication designed to accelerate the transition to ecological sustainability, Charles Darwin University, PhD candidate, (2006).
15. Hart, H. L. A. Are There Any Natural Rights? Theories of Rights. J. Waldron. Oxford OX26DP, Oxford University Press (1984).
16. Atkinson, B.M.C. Reporting Ecological Issues: Steps towards new news values, Master of Philosophy Dissertation (unpublished) School of Journalism, University of Wales, College of Cardiff, UK (1990)
17. Nilsen, T. R. Free speech, Persuasion and the Democratic Process. The Quarterly journal of Speech XLIV(Number 3): 235 - 243(1958).
18. Atkinson, B.M.C. Reporting Ecological Issues: Heralding a Millennium of Replenishment, (unpublished) Charles Darwin University, Darwin, (2002).

Persuasive GERONtechnology: An Introduction

Johanna E.M.H. van Bronswijk

Public Health Engineering for Built Environments, Department of Architecture, Building and Planning, Technische Universiteit Eindhoven, The Netherlands
j.e.m.h.v.bronswijk@tue.nl

Abstract. The motivationally positive property of technologies has both a functional and an attractiveness component. The first one concerns the use of interactive technology to encourage or discourage specific behaviours by controlling the conditions under which they occur. Riding a motorcycle for the excitement, is a good example of the second component.

*Geron*technology, as a service of human health and well-being during development and aging, has been defined in 1991. After 15 years it is time to view the persuasiveness of current and future practices to focus our behaviour and attitude towards a lifespan with enlarged vitality and independence.

1 It Started from Ergonomics

Definitions of technology and aging range from assistive technology, computerized health care, or technology to serve aged persons, to a broader definition encompassing quality of life through the whole life span. In the last case the aim is a technology for a maximum of vital and independent years [1]. It is this approach, first formulated in 1991 in Eindhoven (the Netherlands) and designated gerontechnology, that appears to be especially legitimate in our changing, aging society with its call for extending working phases of life, and reducing costs of care in the later life periods. It is an interdisciplinary effort contributed to by many established scientific and technological disciplines.

Although a young domain, gerontechnology pertaining to the whole life span of man, has already been the subject of a number of studies. Dedicated international conferences were held [2-6], books published [7-8], and a journal erected [9]. A search in general literature databases from the year 2000 onwards [10], revealed another 31 publications (6 in gerontology or ergonomics journals, 15 in other journals, and 10 in conference proceedings).

Most of this published work in gerontechnology focuses on ergonomics. The assumption is that the technology we have, exists and will be used whether it is easy to use or not, e.g., the ATM machine, the automatic telephone menus, or the train-ticket machine that also older persons cannot escape from. Ergonomics deals with making the task of using these machines easier to perform, either by training or improved design or both. However, the motivation to use the technology is assumed. We need access to our money, we need to carry out tasks that use the telephone, and we want to take a train for leisure or work. Persuasive technology extends the depth of analysis of the motivational aspect of technology. It brings more focus to the attractiveness component.

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 183 – 186, 2006.

2 Elderly Participation

The theoretical framework for the gerontechnology domain consists of a matrix with 'Domains of human activity' and 'Technology intervention or impact level' as its 2 dimensions [11].

The question of motivational properties of technology is addressed in the enhancement and satisfaction level of gerontechnological intervention. This is shown by 2 of the 3 design cases in this session: the personal navigation tool of McCreadie et al. [12] and the story telling table of Knipscheer et al. [13,14]. In these cases, active participation in the design process of the target group, the older persons, was realized. The designers aimed at changes in behaviour, such as increased exercise or communication levels, through compensation of failing abilities or restrictions (a different impact level in the gerontechnology matrix). Objective assessment did not show such changes.

To the surprise of the designers, the participation of the end-user in the design of the navigation tool shifted the aim. What was initially meant to be a device focussed on way-finding is slowly becoming a companion for commentary about (interesting) locations!

As to the story table, the cooperative designing process not only changed the outcome of the story table, the process itself caused a major increase in social intercourse and conversation in the assisted living facility where it took place [14]. This is archived in 92 consecutive pictures (http://gallery.waag.org/verhalentafel). Social intercourse needs attractive content in addition to means. Bidirectional video and audio between housebound elders and their friends in the senior centre worked, where e-mailing and chatting with the anonymous internet world lagged behind [11].

The smart pill box of Sterns & Mayhorn [15], the third design case in this session, is an example of 'Support of care and care organisation' as the technological impact level. It is a good example of an upgraded ergonomics approach. Participation of older persons in the design process is more limited, and motivation to take the pills is taken for granted. But the smart technology in a PDA is enjoyed by some of the older users. Fozard & Kearns [11], in their overview, mention other developments in medication adherence, such as the 'Health Buddy' that elicits changes in attitude of the older user.

3 Technology Aided and Traditional Health Interventions

Fogg [16] has defined persuasive technology as: 'interactive computing systems designed to change people's attitudes and behaviours'. De Kort at al. introduced the concept in the domain of Gerontechnology [17] without emphasising the role of older persons as co-designers.

Apparently, we are at the beginning of a new line of thought. Persuasive technology examines more closely how gerontechnology can exert its motivational effects, either through the attractiveness of the technology or the growing ability of interactive technology to shape behaviour. Active participation of older persons in the design process appears to be a key factor in effective persuasion, probably since it bridges the technology-generation gap between older users and younger designers.

Little research has been done in comparing technology based interventions designed to improve life style to 'traditional' approaches. Can technology based interventions do a better job? None of the 3 design examples objectively showed life changes by technologically influencing attitude and behaviour of older persons. But both the personal navigation tool [12] and the story telling table [13] arouse attractiveness feelings in older persons comparable to the excitement that riding a motor cycle does in some people. Interestingly this is comparable to some earlier classical computerless health promotion programs, e.g., in one measured dietary behaviour did not improve as a result of the intervention but over half of the older persons liked the health education program [18].

4 It Ends in Motivation

Persuasiveness originates from the end-users, the older persons themselves, and is included through active participation in the design process. It might result in designs different from the first intentions of the designers, but with increased attractiveness and functionality. The strongest example mentioned in the overview of Fozard & Kearns [11], Fred's motivation and changed attitude, is still a view in the future. Motivation, credibility, trust, control, ethics, ambient awareness, and intelligent agents are issues that need more attention if we are to attain gerontechnology's goal of vitality and independence up to the highest possible age.

This session will show that a start has been made, but that it is still a long way to a real persuasive gerontechnology that brings joy, leaves individuals master of their own situation, and does a better job than the 'traditional approaches' to improve life style. Already Fogg [16] devoted a whole chapter on the ethics of persuasion through technology. Persuasive *geron*technology, as a collaboration of the two new domains of gerontechnology and persuasive technology, could become a breakthrough in our handling of aging issues in society. The role of experience and motivation of older persons in exploiting technological change will remain basic in research and design.

References

1. Bronswijk, J.E.M.H. van, Holt, B.J., Charness, N., Graafmans J.A.M. Gero, Geronn, Geront, Geronto (correspondence). Gerontechnology 3 (2004) 50-54
2. Bouma H., Graafmans, J.A.M. (Eds.) Gerontechnology. Studies in Health Technology and Informatics Volume 3 (Proceedings of the 1st International Conference of Gerontechnology, Eindhoven 1991). IOS Press, Amsterdam (1992)
3. Graafmans, J., Taipale, V., Charness, N. (Eds.) Gerontechnology. A sustainable investment in the future (Proceedings of the 2nd International Conference of Gerontechnology, Helsinki, 1996). IOS Press, Amsterdam (1998)
4. Pieper, R., Vaarama, M., Fozard, J.L. (Eds.). Gerontechnology. Technology and Aging – Starting into the Third Millennium (Proceedings of the 3rd International Conference of Gerontechnology, München, 1999). Shaker, Aachen (2002)
5. Charness, N., Czaja, S., Fisk, A.D. (Eds.). Gerontechnology 2002: Creative use of technology for better aging (Abstracts of the 4th International Conference of Gerontechnology). Gerontechnology 2 (2002) 1-166

6. Sagawa, K., Kurakata, K., Yamaba, K., Nagamachi, M. (Eds.). 5th International conference on gerontechnology (Abstracts). Gerontechnology 3 (2005) 185-270
7. Harrington, T.L., Harrington, M.K. (Eds.). Gerontechnology: Why and How. Shaker: Maastricht (2000)
8. Burdick, D.C., Kwon, S. (Eds). Gerotechnology. Research and Practice in Technology and Aging: A Textbook and Reference for Multiple Disciplines. Springer, New York (2004)
9. Gerontechnology, a quarterly scientific journal, available at www.gerontechjournal.net
10. 'Gero(n)(to)technology' was applied as a search item for all fields in the literature databases Compendex, Medline, Webspirs and Web-of-Science as of November 5, 2005
11. Fozard, J.L., Kearns, W.D. Persuasive GERONtechnology: Reaping technology's coaching benefits at older age. Persuasive story table: promoting exchange of life history stories among elderly in institutions. Proceedings of the First International Conference on Persuasive Technology for Human Well-Being. Lecture Notes in Computer Science. Springer, New York (2006)
12. McCreadie, C., Raper, J., Gunesh, A., Wood, J., Carey, K., Petrie, H., Wood, L., Tyler, S., Biggs, S. Persuasive technology for leisure and health: development of a personal navigation tool. Proceedings of the First International Conference on Persuasive Technology for Human Well-Being. Lecture Notes in Computer Science. Springer, New York (2006)
13. Knipscheer, K., Nieuwesteeg, J., Oste, J. Persuasive story table: promoting exchange of life history stories among elderly in institutions. Proceedings of the First International Conference on Persuasive Technology for Human Well-Being. Lecture Notes in Computer Science. Springer, New York (2006)
14. Hopman, A. A story table: ICT to overcome social isolation. Gerontechnology 2 (2002) 219-220
15. Sterns, A.A., Mayhorn, C.B. Persuasive pillboxes: Improving medication adherence with personal digital assistants. Persuasive technology for leisure and health: development of a personal navigation tool. Proceedings of the First International Conference on Persuasive Technology for Human Well-Being. Lecture Notes in Computer Science. Springer, New York (2006)
16. Fogg, B.J. Persuasive Technology. Using computers to change what we think and do. Morgan Kaufmann, Amsterdam (2003)
17. Kort, Y.A.W. de, IJsselstein, W.A. , Midden, C.J.H., Eggen, J.H., Hoven, E.A.W.H. van. Persuasive Gerontechnology. Gerontechnology 4 (2005) 123-127
18. Mayeda C, Anderson J. Evaluating the effectiveness of the "Self-CARE for a Healthy Heart" program with older adults. Journal of Nutrition for the Elderly 13(2) (1993) 11-22

Persuasive Technology for Leisure and Health: Development of a Personal Navigation Tool

Claudine McCreadie[1], Jonathan Raper[2], Anil Gunesh[2], Jo Wood[2], Kevin Carey[2], Helen Petrie[3], Lucy Wood[4], Ordnance Survey[4], Steve Tyler[4], and Simon Biggs[1]

[1] King's College London, [2] City University,
[3] University of York, [4] Royal National Institute for the Blind

1 Introduction

As the number and proportions of older people grow, those living in developed economies are increasingly likely to enjoy an active and healthy period of their life. During this time they are free to pursue old, and new, leisure interests and to travel around, both locally (often in towns, with the aid of concessionary, or free, travel passes) and to more distant places. Younger older people (up to age 75), people on higher incomes and people in better health are all more likely to move around more [1]. These trends are likely to increase in the future [2]. Meanwhile, technology developments in mobile telephony and geographic information systems are making it possible to locate the geographic position not only of vehicles and boats but also of people on foot [3]. These technical developments inspired the team working on this project to apply the sophisticated technology associated with Geographic Information Systems (GIS) , Global Positioning Systems (GPS) and Location Based Services (LBS) to address the pedestrian navigational needs of two groups of people who are frequently excluded from commercial design concerns. As well as older people, the research is addressing the needs of people with severe visual impairments. However, to date, the major thrust of fieldwork has focused on older people.

The research is being funded under a government sponsored programme designed to put people at the centre of communications and information technology [4]. The requirement to make user involvement central to the research design has led the researchers to adopt an iterative technology. Prior to any technical development, the researchers aimed to assess the experiences, needs and preferences of a small (n=32) sample of older people about where and how much they walked, and what problems they encountered in finding their way to places [5]. The first phase of technical work then followed and an initial prototype was developed. This was trialled in April 2005 with a very small sample (n=5) of users who gave substantial feedback on the prototype. Further technical development took place, followed – in October 2005 - by a second round of trials with the original five users, and five to whom the research was quite new. More technical work is now following the feedback from Round 2 of the field trials and further testing is expected to take place in Spring 2006.

2 First Stage of Developments

The technology under development is concerned with route planning, route progress monitoring and access to information about surrounding points of interest. The

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 187 – 190, 2006.

researchers have access to the most up to date mapping information from their partnership with the Ordnance Survey, Great Britain's national mapping agency. The prototype device is a Personal Digital Assistant (PDA) with web access and GPS, using a web browser for the interface and a platform developed in previous research [6]. The first stage technical developments were informed by the initial user interviews with 13 men and 19 women, with an age range of 70 to 86 years and a majority (82%) of respondents aged 80 and over. These found that most respondents went out daily and many regarded this as important for their morale and ability 'to keep going'. The majority of journeys were routine ones using familiar routes. Even when people moved out of their localities, they tended to go to places that they knew. Most people, if they did go somewhere unfamiliar, did so as part of an organised group. However, even among respondents at the upper end of the age group, there were those of a more 'adventurous' disposition who enjoyed going on trips, or travelling in Britain or abroad. They tended to use maps to find their way in unknown places, or asked people. Generally the main problems with maps related to the size of print and difficulties in reading it clearly. Nonetheless, even among these older respondents, twelve out of 32 were enthusiastic about the idea of the innovation and thought that the technology might be useful – for someone else, even if not for themselves, or specifically in an unfamiliar environment. The three Location Based Services that respondents thought it would be most useful to know about were: toilets, transport information and places of cultural and historical interest but many suggestions were made [5]. These findings informed the initial technical developments.

3 Lessons from Testing the First Prototype

The first prototype was tested with five users in a small area of Hyde Park in London in April 2005. Four of the five trial participants had been involved in the initial interviews. There were three men and two women with an age range of 72 to 86. After an initial briefing by one of the researchers (AG), each participant walked a predefined route accompanied by three researchers (AG, CMcC and JR or colleague). One (AG) walked directly with the participant and gave them help in using the device as required, while the other two made observations on the participant's responses. Following the walk which took between 30 and 45 minutes, CMcC interviewed the participant, using a semi-structured questionnaire together with some structured questions on socio-demographic data. The key issues arose in relation to usability, mapping and orientation. Overall, participants found the device 'user friendly', although there were useful comments on points of detail. The maps were generally praised for their clarity although a number of issues arose in relation to scale and to points of interest that had not been included for this iteration. Most of the significant issues around the technology related to orientation and in particular to the relationship of the map to 'real time' location, since the map faces north as with any conventional map, and users commonly turned the device around so that the track oriented with their walking direction. This however meant that the map symbols were upside down. Overall the five respondents varied in their response to the prototype and this was not related either to age or to gender. The two most enthusiastic were also the two people who were most familiar

with, and confident about using mobile phones – a man of 81 and a woman of 86. The other three participants were sceptical to a greater or lesser degree.

4 Next Stages

In the light of this first trial, the research team felt that orientation needs were paramount and that users needed to be persuaded by rock solid implementation and 'super-simple' design. During the summer of 2005, further technical work was undertaken to address these and other issues raised in this initial trial. By October 2005, a second prototype was ready and the original five participants and five more who were new to the device took part in this second trial. The results are currently being written up but indicate that it is the combination of positioning and 'points of interest' information that is likely to be valued by older users. In the course of the iterations, the navigation tool is evolving by design from a device focused on way-finding to one focused on commentary about location. The capability of providing a commentary on the surroundings opens up new opportunities for the user and enriches their knowledge of their surrounding environment. This distinguishes the device clearly from conventional maps. These, while indicating landmarks, are unable to give further details thereby requiring people to carry a guidebook with them. A crucial advantage of the personal navigation tool as it is being developed in our research is that it can provide users with a wide range of information about the area they are visiting as well as providing them with route planning and positioning data.

Although, at the outset of this research, the technical developments were seen as helping in some way older people who had some limitation in their ability to get around, it has become increasingly clear that the innovation has a much wider application. Although not developed with the purpose of promoting exercise, and therefore improved health in later life, or of increasing life-long learning opportunities it may have the capacity to be just that kind of persuasive technology. The educational component through the points of interest facility is already strong. From a health promotion point of view, it would not be difficult to incorporate a distance calculator, or other criteria relevant to 'fitness' in line with innovations for younger age groups [7]. If the technology is 'correct' for the users, in terms of simplicity of operation, accuracy and reliability, it may have considerable appeal to older people, who are benefiting from the enhanced leisure opportunities that come with more free time and are increasingly conscious of health promotion and of educational opportunity. The device may equally benefit those living in urban areas where there is much to be seen and enjoyed by just walking around, or those in rural areas who want to explore the countryside. In this way, it has considerable potential for enhancing the quality of life of considerable numbers of people. At the same time, recognising the importance of Inclusive Design [8], it is possible that the attention given to addressing the needs of older users will have more widespread benefits in relation to a broader population.

References

1. Marmot, M., Banks, J., Blundell, R., Lessof, C., Nazroo, J.: Health, wealth and lifestyles of the older population in England. The 2002 English Longitudinal Study of Ageing. The Institute for Fiscal Studies, London (2003)
2. Metz, D., Underwood, M. Older, richer, fitter. Age Concern England, London (2005)
3. Krug, K., Mountain, D., Phan, D. Location-based services for mobile users in protected areas. Geoinformatics. 6 (2003) 26-29
4. www.paccit.gla.ac.uk
5. McCreadie, C. Older pedestrians, mobile phones and new way-finding technology: first stage of new research. Gerontechnology 4 (2005) 5-14
6. Mountain, D., Raper, J.F. Positioning techniques for locaion-based services (LBS): characteristics and limitations of proposed solutions. ASLIB Proceedings, 53 (2002) 404-412.
7. See for example: http://bonesinmotion.com/corp/products.html
8. Clarkson, J., Coleman, R., Keates, S., Lebbon, C. Inclusive Design. Design for the whole population..Springer London (2003)

Testing the first prototype navigation aid in Hyde Park London in April 2005

Persuasive Story Table: Promoting Exchange of Life History Stories Among Elderly in Institutions

Kees Knipscheer, Jasper Nieuwesteeg, and Johan Oste

Vrije Universiteit Amsterdam, Faculty of Social Sciences, Amsterdam, The Netherlands

1 Introduction

Technicians from the Waag Society in Amsterdam developed an intelligent story-telling table, to be used in institutional care facilities for older persons. The core of the table is a video-equipment with installed 15 to 25 short video's (5 - 15 minutes) with historical stories from the years 1920 – 1950. Around the table there are 4 –6 TV-screens to look at the video's. The screens are located on a somewhat lower platform, in order to enable those who are sitting around the table to offer the best possibility to see the screen and each other and to exchange experiences from earlier life. The short video's are meant to start a process of exchange among those around the table by commenting on the video and telling their own life stories [1]. The involvement in the storytelling process was expected to promote social and emotional wellbeing and cognitive functioning.

An experimental design was developed to see whether the participation in story-telling table sessions would work out in an increase in social participation, in emotional well-being and in a higher level of cognitive functioning. Institutional environments are often characterised by a lack of sensorial stimuli or a limited amount of opportunities to meet other people. The Story-telling Table intends to contribute to overcome these deprivations and to offer an appealing way of activating the residents and eliciting their own input in the event. It stimulates social, cognitive and physical engagement on a regular basis and helps to develop new contacts in the institutional environment.

2 Methodology

An experimental study design was developed and implemented in 8 institutional care facilities that were willing to participate in the study. In each institution a welfare assistant was appointed to supervise weekly sessions with the story-telling table of 4-6 respondents during a time period of 16 weeks.

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 191 – 194, 2006.

In total 181 residents were recruited to participate, and 123 completed their participation up to the post experimental observation. Participants aged between 60 and 90 years; 83 were 70 years of age or over. Of them 46 were in the experimental group (with story-telling table sessions) and 77 in the control group (without exposure to the story-telling table, no compensating activity was set up). The first observation among the experimental and the control group was a week before the first session of story-telling. The second observation was after the period of 16 weekly sessions.

Next to the quantitative measurements for the experimental design some qualitative measurements were done to establish the subjective experiences of the participants and the supervisors. Outcome measures concerned (i) social relationships, a Dutch inventory scale for regular contacts was used [2], (ii) emotional well-being: several instruments were used, Jong-Gierveld loneliness Scale [3], Geriatric Depression Scale [4], Pearlin and Schooler Mastery Scale [5], and (iii) cognitive functioning: Mini Mental Status Examination [6].

The analysis focused on changes in the outcome measures between the first and the second observation, for both the complete experimental and the total control group. In a second analysis the experimental group was split into a group that was high in loneliness / depression and a group that was low in this respect, a group that was low in mastery and cognitive functiong and a group that was high. A third analysis split up those who participated in more than 70 % of the sessions and those who participated less.

3 Results

Participating in the story-telling sessions did not have significant outcomes on either of the dependent variables (confidence level of 0.05). No changes occurred in the number of contacts, loneliness and depression did not decrease, mastery and cognitive functioning did not increase.

After separating those high on loneliness a significant decrease in loneliness showed up, however this happened also among the control group (see table 1).

Table 1. Average loneliness scores on the De Jong-Gierveld scale [2] for the experimental and control group, comparison before and after the intervention; significant differences in bold; confidence limit 0.05; Score range 1-11

	Experimental group			Control group		
	N	Before	After	n	Before	After
Scores of all participants	46	3.13	3.04	77	3.66	3.48
Score ≥3	22	**5.50**	**4.32**	49	**5.24**	**4.57**

Selecting those moderate and high on depression (a score of ≥4 on the GDS scale (criterion 1), and a score of ≥6 (criterion 2), both criteria appeared to be clinical relevant in earlier research [7,8,9]) showed only a significant result for the moderate depressed of the control group (see table 2). Selecting those low in mastery and those low in cognitive functioning did not show any significant increase in mastery and cognitive functioning.

Table 2. Average depression scores of experimental and control group, before and after intervention with the story-telling table experiment; significant differences in bold; confidence limit 0.05; Score range 0-15

	Experimental group			Control group		
	N	Before	After	n	Before	After
Scores of all participants	46	2.83	2.93	77	2.99	2.76
Score ≥4	14	6.36	6.07	24	**6.25**	**4.88**
Score ≥6	7	8.43	8.00	15	7.33	5.87

Adding a distinction in level of participation in the Story Telling sessions did not change the picture much for either of the dependent variables. However, there was one exception. Those low in mastery and participating in more than 70 % of the sessions increased significantly in mastery (mastery before =19,14 and after =22,57, p≥ ,05; n=7).

Despite the limited results of the participation in the story-telling table the qualitative study among participants and supervisors delivered some interesting findings:

(i) Three functions of the table were identified: fun, social contact promotion and story telling eliciting,. E.g. “nice topics, pleasant time spending, interesting talks, good company, nice way to get in contact with new people”.
(ii) Participation in the story-telling table leads toward better contact among residents and among residents and personnel of the institution. E.g. “to get to know people differently … otherwise this does not happen so easy”.
(iii) The story-telling table is a an efficient way to raise subjective historical awareness; it pushes people to tell personal stories,
(iv) Personnel of the institutions appreciates the story-telling table equipment; it is an additional option for activities and easy to use. E.g. session leaders mention: “first there were some doubts … however it is fascinating to see how moving pictures work”.
(v) Future use may include sessions together with grandchildren and among psycho-geriatric residents.

4 Conclusions

In general participation in sixteen weekly sessions of the story-telling table did not result in a significant decrease in loneliness feelings and in depression. Focussing on those who were before low on mastery and participated on a high level in the experiment, reached a higher level of control. In contrast to the limited results in the experimental study, the qualitative part looks more promising. That is why it appears to be worthwhile to continue to develop the experimental setting and see what the outcome in other studies may be as to the persuasiveness of Story-telling tables in institutional assisted living [10].

References

1. Hopman, A. A story table: ICT to overcome social isolation. Gerontechnology 2 (2002) 219-220
2. Linnemann, M.A., Leene, G.J.F., Bettink, K.W., Schram, M., Voermans, H.W. (1990). Uit eenzaamheid: over hulpverlening aan ouderen. Houten: Bohn Stafleu Van Loghem
3. Jong-Gierveld, J. de, Kamphuis, F.H. The development of a Rasch-type loneliness Scale. Applied Psychological Measurement 9 (1985) 289-299
4. Yesavage, J.A. , Brink, T.L., Rose, T.L., Lum,O., Huang, V., Adey, M., et al. Development and validation of a geriatric depression screening scale: a preleminary report. Journal of Psychatric Research 17 (1982) 37-49
5. Pearlin, L.I., Schooler, C. The structure of coping. Journal of Health and Social Behaviour 19 (1978) 12-16
6. Folstein, M.F., Folstein, S.E., McHugh, P.R. Mini- Mental State. A practical method for grading the cognitive state of patients for the clinician. Journal of Psychiatric Research, 12 (1975) 189-198
7. Almeida, O.P., Almeida, S.A. Short versions of the geriatric depression scale: a study of their validity for the diagnosis of a major depressive episode according to ICD-1- and DSM-IV. International Journal of Geriatric Psychiatry 14 (1999) 858-865
8. Schreiner, A.S., Hayakawa, H., Morimoto, T., Kakuma, T. Screening for late life depression: cutt-off scores for the Geriatric Depression Scale and the Cornell Scale for Depression in Dementia among Japanese subjects. International Journal of Geriatric Psychiatry 18 (2003) 498-505
9. Vinkers, D.J., Stek, M.L., Gussekloo, J., Mast, van der R.C., Westendorp, R.G.J. Does depression in old age increase only cardiovascular mortality? The Leiden 85-plus Study. International Journal of Geriatric Psychiatry 19 (2004) 852-857
10. Nieuwesteeg, J.J., Osté, J.P., Horn, L., Knipscheer, C.P.M. De Verhalentafel. Een studie naar de effecten van de Verhalentafel op bewoners van zeven verzorgingshuizen / woonzorgcentra. Centrum voor Verouderingsonderzoek, Vrije Universiteit & VU medisch centrum, Amsterdam (2005), ISBN 90 809525 1 6, More info at: www.verhalentafel.nl/html/home.html

Persuasive Pillboxes: Improving Medication Adherence with Personal Digital Assistants

Anthony A. Sterns[1] and Christopher B. Mayhorn[2]

[1] Creative Action LLC, University of Akron, University of Maryland, University College,
680 N. Portage Path, Akron, OH 44303, United States
drtone@gmail.com
[2] Department of Psychology, North Carolina State University,
640 Poe Hall, Campus Box 7801, Raleigh, North Carolina, 27695-7801, United States
Chris_Mayhorn@ncsu.edu

Abstract. Personal digital assistants (PDAs) can be used persuasively to change attitudes regarding medication taking, thereby facilitating adherence for older adults. A pillbox that integrates onto the body of the PDA was created as a place to store mid-day pills. Results from a lab and field experiment on older adults' perceptions and use of PDAs for medication minding are reported. In both the lab and field experiment, older adults were successfully trained to use PDA standard programs and a program for medication reminding. At the conclusion of the 3-month field experiment, a physical pill count yielded increased compliance with two-thirds of the participants missing 1 pill or less in the third month of the study. Implications for PDA training curricula, hardware design, and future research are discussed.

1 Introduction

Medication-related problems represent a huge cost to the United States economy. Over $76 billion dollars (Johnson & Bootman, 1995) are spent annually on medical complications caused by not taking medication appropriately. Unfortunately, the cognitive and perceptual changes that co-occur with age make older adults susceptible to medication errors (Park & Jones, 1997). One approach to improving medication adherence is through the use of personal digital assistants (PDAs). The purpose of this paper is to describe how a PDA training program used in conjunction with specially designed software, like the RxReminder™ software described here, can change the attitudes of older adults to improve medication adherence. As our goal is to effect change in medication adherence behavior in a predetermined way, the use of PDAs in this fashion is certainly persuasive as defined by Fogg (1999).

1.1 Identifying and over Coming Barriers to Training and Usage

The realization of the potential benefits of PDAs is dependent on the attitudes and usability needs of this special population. For instance, if one does not possess a positive attitude in the utility of learning to use such a device, the PDA is not likely to

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 195 – 198, 2006.

be adopted to assist medication adherence tasks. It has been reported (Mayhorn, Lanzolla, Wogalter, & Watson, 2005) that older adults take longer to learn to use PDAs and commit more errors when entering information into a PDA-based medication software application. Efforts to overcome these behavioral and attitudinal barriers must include well–designed training targeted to older adults to teach PDA usage skills as well as creating software with improved interface and operation.

Fig. 1. The PDA Pillbox Prototype (patent pending) on the Samsung i300. The pillbox could hold a day's worth of pills, improved stylus access, and allowed wireless infrared transfer.

Persuasive Software and Pillbox. To increase the number of people who can benefit from the features a PDA can offer, the barriers to using the device must be addressed. Special usage skill training is required (Sterns, 2005) as well as creating software with improved interface and operation (Czaja & Lee, 2001) to improve the likelihood of success for the participants. RxReminder™ is a software application designed to meet these criteria. This reminder program is capable of showing pictures of drugs so that the shape, color, and markings of the pills can be clearly seen. It is also important to link the reminder program and the medications. To accomplish this task, Sterns designed a patented pillbox attachment that would integrate with the PDA to provide a way to carry mid-day medications or supplements (See Fig. 1).

2 Overview of Research

To systematically address the likelihood that older adults can learn to use PDAs to improve their medication adherence, two studies were conducted. In study 1, young and older participants were asked to complete a PDA-based medication entry task in the laboratory before completing a usability questionnaire that also assessed attitudes regarding PDA usage. This data provided "proof of concept" information regarding the PDA-trainability of older adults. Study 2 was conducted to determine whether lab-based results could be extended to the field during actual medication adherence.

2.1 Study 1 – Lab Evaluation of PDAs by Young and Old Adults

The purpose of the lab study was to determine perceived usability of PDAs by 26 young (Mean age of 18.6 years, SD = 1.36) and 25 older adults (mean age of 67.3 years, SD = 5.25). To supplement an experimental task that required participants to enter medication data into a commercially available PDA-based software application

(reported in Mayhorn, et al., 2005), participants were also required to complete a usability questionnaire. Perceived PDA usability was measured using six rating scales: (a) overall satisfaction, (b) simplicity of operation, (c) ease of medication information entry, (d) ease of learning, (e) error recovery, and (f) likelihood of future use. Participants rated their agreement to each rating statement using a seven-point Likert scale with anchors ranging from 7 "Strongly Agree" to 1 "Strongly Disagree." The goal was to determine whether age differences in perceived PDA usability are present following interaction with these devices and how changes in attitudes might influence the likelihood of future use. Thus, the persuasive aspects of PDA usage are being measured here.

Usability Agreement Ratings. The mean usability agreement ratings for each age group are shown in Table 1. For all items, the mean agreement rating was above 4.80, which indicates that each age group on average held positive attitudes regarding their first experience with PDAs. T-tests revealed age differences in perceived usability for five of the six statements. Younger adults rated the PDAs as significantly easier and simpler to use and rated the ease of learning to use the devices as higher than that reported by the older adults; $t(49) = 2.80$, $p < .01$, $t(49) = 3.42$, $p < .01$, and $t(49) = 2.46$, $p < .01$, respectively.

Table 1. Mean usability agreement ratings

	Young	Older
Overall satisfaction	6.42	5.72**
Simplicity of operation	6.50	5.68**
Ease of learning	6.46	5.92**
Error recovery	6.31	4.80**
Likelihood of future use	5.15	5.24

Note. *p <.05, **p < .01.

Although the performance data (reported in Mayhorn et al, 2005) revealed that older adults require more time to learn to use PDAs and make more errors than young adults, it should be noted that these errors declined with practice over time. Coupled with the perceived usability information reported here, older adults' difficulty using PDAs apparently does not translate into decreases in positive attitudes regarding their use. While these data illustrate that older adults can learn to use PDAs in the laboratory, the field experiment described next illustrates that these results can be generalized to improve medication adherence.

2.2 Study 2 – 3-Month Use Test with Older Adults

Study Design. Forty–four community–dwelling participants ranging in age from 56 to 89 (average age of 72 years) completed training; 90% of those recruited. Training procedures and results are documented in Sterns (2005). A physical count of the pills using a pharmacy tray was conducted for the participants at the beginning of the study

and at the end of each month for 3 months. Adherence of up to 2 prescriptions or 1 supplement was tracked. Participants took between 1 and 18 medications (M = 3.8, SD = 2.7) and over–the–counter supplements (M = 3.5, SD = 2.1) daily.

3 Results

Medication Adherence Results. The average missed pills were 1.04, 2.43, and .05 pills in months 1, 2, and 3 respectively. We found that 24 individuals, 57% of those counted in the third month of the study had perfect adherence and 28 individuals, 67% of those counted in the third month had missed no more then one pill. Eleven of twelve (92%) of those who took mid-day pills used the pillbox.

4 Discussion

Collectively, the results of both studies indicate that older adults can be trained to use PDAs and that these devices can be used to promote medication adherence in the field. Furthermore, findings indicate that older adults hold generally positive attitudes towards learning to use this new technology and that they found the devices to be usable when appropriate training was made available.

Future research might focus on further improving device usability for a number of other applications such as banking, communication, and warning systems. Through the use of iterative design methodologies, the specialized needs of older adults can be met. Such work should result in an increased likelihood of retaining independence and improving safety for community dwelling older adults.

References

Czaja, S. J. & Lee, Chin Chin (2001). The Internet and older adults: Design challenges and opportunities. In N. Charness and D. Park (Eds.), *Communication, technology and aging: Opportunities and challenges for the future.* p. 60-78. Springer Publishing Co, Inc: NY, NY.

Fogg, B. J. (1999). Persuasive technologies-Now is your chance to decide what they will persuade us to do-and how they'll do it. *Communications of the ACM, 42*(5), 26-29.

Johnson, J. A. and Bootman, J. L. (1995). Drug related morbidity and mortality. *Archives of Internal Medicine*; 155: 1949-1956.

Mayhorn, C.B., Lanzolla, V. R., Wogalter, M. S., and Watson, A. M. (2005). Personal digital assistants (PDAs) as medication reminding tools: Exploring age differences in usability. *Gerontechnology, 4* (3), 128-140.

Park, D. C., & Jones, T. R. (1997). Medication adherence and aging. In A. D. Fisk & W. A. Rogers (Eds.), *Handbook of human factors and the older adult* (pp. 257-287). Hillsdale, NJ: Lawrence Erlbaum.

Sterns, A. A., (2005). Evaluation of a Curriculum Design and Program to Train Older Adults to Use Personal Digital Assistants. *The Gerontologist.*

Persuasive GERONtechnology: Reaping Technology's Coaching Benefits at Older Age

James L. Fozard and William D. Kearns

University of South Florida, Tampa, USA

Abstract. The keynote speaker for this conference, Dr. B.J. Fogg, defines persuasive technology as, "interactive computing systems designed to change people's attitudes and behaviors." [1]. Such changes find their origin in changes in people's motivation. The coaching possibilities of technology may be viewed as an embellishment of conditioning and behavior therapy.

With respect to aging, most people want to live a long life—indeed as long as possible—but they don't want to grow old. Literally dozens of formal and informal surveys about the ambitions and desired activities of old people have been performed [2]. The results highlight the desire of older persons to maintain their accustomed way of life, maintain and identify new social contacts; and identify and develop new recreational, educational and artistic activities, some that replace or modify earlier ones associated with family and work.

With this background in mind, we will discuss persuasive technology as coaching benefits in relation to the ambitions, activities and wisdom of people as they age.

1 Gerontechnology: Multiple Roles

Recognition of the ambitions of older persons has led to the development of Gerontechnology [3]. It provides a four-step framework for linking technology to the ambitions and activities of older persons [4]. ***The first two steps*** are combined in a 2-dimentional matrix (see below). ***The third step*** contains the type of functioning being targeted by the intervention: physical, cognitive or emotional/social. ***The fourth step*** concerns the selection of type and site of intervention. It includes training and motivating a person to change behaviour or attitude.

Gerontechnology matrix showing 4 types of technological interventions on 5 domains of human activity

Technology Intervention	***Domain of human activity***				
	Health & Self esteem	Housing & Daily activities	Communication & Governance	Mobility & Transport	Work & Leisure
Enhancement & Satisfaction					
Prevention & Engagement					
Compensation & Assistance					
Care & Organization					

The following paragraphs discuss some applications of coaching technology to maintain or enhance physical, cognitive or social/emotional functioning on the different technology-intervention levels.

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 199 – 202, 2006.

2 Physical Function

At the level of care and organization, there have been several important developments in caring for disabled elderly persons using machines with interactive and adaptive capabilities that help restore part of their independence attitude.

Montemerlo, Pineau, Roy, Thrun, and Varma [5] tested a robotic assistant named 'Pearl' in an assisted living facility. The robot reminds patients of upcoming doctor visits, escorts them to the physician's office, and provides a stable platform to support slow moving patients. Speech recognition software allows the robot to respond to patient requests. Montemerlo's patients reported being generally pleased with the functionality of the robot.

Yoshimi et al. [6] have devised a mobile robotic information home appliance which comes when spoken to by the user, can operate other home appliances via infrared controller and present e-mail or other communications through the home's network infrastructure. In practice, this device would attend to the elder's needs and function like a butler.

Husemann, Narayanaswami and Nidd [7] have described a 'Mobile Health Toolkit' integrating cellular telephones having Bluetooth or 802.11 capabilities with wireless medical devices such as blood pressure cuffs, pill reminders, digital blood glucose monitors, activity monitors, respirometers, and even needle injection monitors. In practice, a wireless connection would be established between the cellular telephone and any or all of the medical devices within approximately 10 meters. Each time a device was used the time, date, and parameters measured would be relayed by phone to the patient's medical records at a remote server. Failure to adhere to a regimen would be detected by a correlation engine running on the cellular phone.

3 Cognitive Function

Pharmaceuticals have shown some promise in slowing dementia's progress, but only if the afflicted person remembers to take the medication. Networked microprocessor devices like the 'Health Buddy' which link service providers directly to elders at home (telemedicine) have demonstrated changes in attitude with improved compliance with medication regimens [8].

In a novel application of GPS enhanced cybernetic technology, Digital Angel, Inc. has developed an entire system to restore some independence in persons with moderate dementia. It uses a cellular telephone's onboard advanced computational abilities and built-in GPS to establish a perimeter (termed a 'geofence') around the home. Wanderers automatically reveal their position to their caregivers through a server based notification system. One intriguing variant of their approach is that a wanderer who crosses a geofence could be redirected to his home by verbal directional cues delivered by a networked system similar to the Patterson, Etzioni and Kautz's [9] 'Activity Compass'. For example: "Please turn around and face the house. Walk back to the house. Enter the house."

4 Social/Emotional Function

Enhancing communication by e-mail is the most popular use of the internet by persons of all ages, yet today's elderly still lag behind [10]. Heeter, Gregg, Climo, Biocca, & Dekker [11] described case studies of elders whose attendance at senior centers was curtailed due to illness. After each senior had bidirectional video and audio installed in their homes to allow them to interact in realtime with friends at the centers, isolation and feelings of depression diminished.

Technology for hobbies, e.g., processing digital images at home, various games, etc., with computer software has not been pursued as much by older as opposed to younger adults. This may relate to the perceived difficulty of using the technology. For older users, part of the frustration with the equipment is caused by the difference in technology generation between the older user and the younger designer. Bouwhuis and Melenhorst [12] point out that older persons, perceiving the cognitive effort required to master new technology as high, choose not to invest that effort in mastering a technology of uncertain utility. The role of experience and motivation in reaping the benefits of a persuasive technology requires continuing research.

5 The Future: Fred's Motivation and Changed Attitude

The following fictitious vignette shows how a future persuasive GERON-technology system could be used in a program that seeks to prevent deterioration of health. Fred, a divorced man of 65 who smokes, is overweight and cares for his elderly mother in an Assisted Living Facility (ALF). Fred has hypertension and a family history of diabetes, both made worse by his overweight condition and a diet of high sugar soft drinks. Fred sees his mother once a month at the local ALF, and suspects that she's not getting the kind of care she deserves based on what he's providing and what Medicare is paying. He knows he needs to see mom more often, but there never seems to be the time to get across town to see her and follow up on her care. Fred's health insurance premiums have been rising due to risk indexing, a new practice which makes persons with bad health habits pay higher premiums than people with good health habits. His increased girth and weight strains the rickety stairs to the basement, potentiating a fall. Fred recognizes that he needs to stop smoking, lose weight, diet. He realizes his time management skills are poor.

What should Fred do? His problems fall largely within the domains of Health & Self esteem, and Housing & Daily activities (see matrix above). Technology can be used to address his issues in prevention, care and enhancement. His motivation to use the technology is high in some areas (he doesn't want to die, and his health insurance premiums are rising while his budget is fixed), but low in other areas, seeing that his mother is well taken care of, and maintaining safety in his home.

Fred seeks the assistance of his physician to establish an exercise plan with a goal to increase his power walking by 1 city block per week. His highly innovative health insurance program is endorsing his efforts by providing him with a GPS based tracking system which will provide vector information on his walking excursions and automatically track his progress. As he gets into shape, his real-time insurance premium calculator will show how much lower his premiums will be if he continues

the program. As the program progresses, Fred's finding it difficult to continue smoking as he increases his power walking; he finds himself unable to breathe easily while walking. As a result he's had to decrease smoking in order to get the savings he wants in premiums. Fred began calling his mother more frequently and using an Internet based video calling program to see how she's doing at the ALF. The video quality is good, allowing him to see that mom's condition is poor, providing motivation enough for Fred to make a visit to his mother's ALF.

Fred's story is fictional, but a number of elements and functions in this story are already on the market, as shown above.

References

1. Fogg BJ. Persuasive technology: Using computers to change what we think and do. Amsterdam, Morgan Kaufmann, 2003
2. Mollenkopf H, Fozard JL. Technology and the good life: Challenges for current and future generations of older people. In Wahl H-W, Scheidt RJ, Windley PG, editors, Annual review of gerontology and geriatrics vol.23. New York: Springer, 2004, pp 250-279
3. Bronswijk JEMH van, Bouma H, Fozard JL. Linking the impacts of technology to its areas of application that most affect quality of life. Gerontechnology 169-172,2003
4. Fozard JL. Impacts of technology interventions on health and self-esteem. Gerontechnology 463-76, 2005
5. Montemerlo M, Pineau J, Roy N, Thrun S, Varma V. Experiences with a mobile robotic guide for he elderly. In National Conference on Artificial Intelligence. AAAI, August 2003
6. Yoshima T, Matsuhira N, Suzuke K, Yamamoto D Ozake F, Hirokawa J, Ogawa H. Development of a concept model of a robotic information home appliance, ApriAlpha. Proceedings of 2004 IEEEmSJ International Conference on Intelligent Robots and Systems. Sendai JP Sept 29-Oct 2, 2004
7. Husemann D, Narayanaswami C, Nidd M. Personal mobile hub. In Proceedings of the International Symposium on Wearable Computers, ISWC'04, pp 43-49
8. Bigelow JH, Cretin S, Solomon MD, Wu S, Cherry J, Cobb H. O'Connell M. Patient compliance with and attitudes toward Health Buddy ™ Downloaded from http://www.rand.org/pubs/monograph reports/ MR1232/ on 1/26/06
9. Patterson C, Etzoni O, Fox D, Kautz H. The Activity Compass. In Proceedings of UbiCog'02: First International Workshop on Ubiquitous Comuputing for Cognitive Aids. Gothenberg, Sweden. Downloaded from http://www.cs.washington.edu/homes/dip3/AI/-AssistedCognition/publications/compass03.doc on 1/26/06
10. Fozard, JL, Kearns WD. Impacts of technology interventions on communication in aging and aged persons. In G Lesnoff, editor, Gerontechnology. Springfield IL: C. Thomas, in press
11. Heeter C, Gregg J, Climo J, Biocca F, Dekker D. Telewindows: Case studies in asymmetrical social presence. In Riva G, Davide F, IJsselsteijn WA, editors, Being there: Concepts, effects and measurement of user presence in synthetic environments. Amsterdam: IOS Press, Vol.5 pp 279-294
12. Bouwhuis DG, Melenhorst A-S. Perceived cost-benefit ratios of using interactive communication equipment. In Sagawa K, Bouma H. editors, Proceedings of the International Workshop on Gerontechnology, Tsukuba JP, National Institute of Bioscience and Human-Technology, March 2001, pp 75-78

perCues: Trails of Persuasion for Ambient Intelligence

Manfred Tscheligi, Wolfgang Reitberger, Christoph Obermair, and Bernd Ploderer

HCI&Usability Unit, ICT&S Center,
University of Salzburg, Sigmund-Haffner-Gasse 18,
5020 Salzburg, Austria
{manfred.tscheligi, wolfgang.reitberger, christoph.obermair,
bernd.ploderer}@sbg.ac.at
http://www.icts.sbg.ac.at/

Abstract. The realization of the ambient intelligence (AmI) vision will have a profound impact on our everyday lives and society. AmI applied in contexts like homes or public spaces will not only affect individual users but influence entire groups of users. The question is how we can apply such technologies to persuade groups and individual users. Our approach is to design AmI environments by borrowing a concept which works very well in biological and social systems: Collective Intelligence (CI). The intelligence of a group surpasses the individual intelligences and leads to improved problem solving capabilities of individuals and groups. From nature we borrow examples of cues in the environment to stimulate goal directed collective intelligence (perCues). The application of perCues in AmI environments helps to persuade users to reach a common goal like decreasing environmental pollution. Adopting CI for AmI we blaze a trail for the design of persuasive AmI environments.

1 Introduction

Ambient Intelligence (AmI) emerged from the developments of ubiquitous computing [1], natural interaction and intelligent systems. The AmI vision describes the pervasion of the everyday world with digital technology which is able to anticipate the user's needs and to support the user in fulfilling these needs [2]. AmI adapts to the requirements of the users and reacts to their presence.

The goal of this paper is to blaze a trail for the use of AmI environments to positively influence and persuade groups and individual users. Moreover these environments aim to increase the users' problem-solving capabilities. Our approach towards persuasion in AmI is informed by the concept of Collective Intelligence (CI). Humans can solve problems more efficiently together than alone as shown in social psychology research [3] demonstrating the phenomenon of collective intelligence. AmI goes beyond the classical single user - computer interface and allows us to involve a larger number of people. Examples of CI in nature show us efficient ways for the design of AmI environments fostering CI among humans. In this way we aim to persuade people to behave in a sustainable manner.

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 203 – 206, 2006.

2 Collective Intelligence

Collective Intelligence names the increased problem-solving capacity that results from synergetic effects of interacting intelligent agents [4;5]. CI leads to cooperation between individuals, but not to collectivization, there is a delicate balance between individuality and relations (collective). CI is a form of universal distributed intelligence which is constantly enhanced and coordinated in real time. Levy also stresses the use of appropriate communication structures for the coordination of CI in real time [5]. These structures can also be built with digital communication technologies. CI improves the problem solving capability of a system since a group of people has better problem solving capabilities that it's individual members alone.

Related approaches in HCI are distributed cognition [6] and social intelligence [7]. Both approaches are relevant to CI, however CI does not only describe the relations between individuals but can be described as a goal for a group to be reached. Only under certain circumstances can individuals profit from CI leading to increased problem solving capabilities.

2.1 Collective Intelligence in Natural Systems

In some cases, the evolution has combined hundreds and thousands of individual brains to higher entities. Ants, bees (and also other insects) display collectively intelligent behavior when foraging for food or fighting off predators. Each ant in the colony acts in a rather simple way, but together they end up doing something intelligent, like discovering the shortest path between their ant hill and a food source.

In a bee colony no individual bee knows about the geographic distribution of all food sources in the area. It decides based on the food requirements of the entire colony if a certain food source is worth being exploited. A single bee is not informed about a global measurement like the food requirements of the colony, but it can deduct this in-formation from a local cue in the environment: the length of the queue at the hive [8].

2.2 Ambient Intelligence Informed by Collective Intelligence

CI has been applied to the cyberspace [5], to multi-agent systems, and artificial intelligence [9]. Shirvanee and Davenport [10] used CI for a better understanding of social experiences in public spaces. Our approach is to adopt the concept of CI and especially particular cues in the environment for persuasive AmI environments. We propose the concept of *perCues* to describe ambient cues towards persuasion. perCues present visual stimuli in the environment (ambient displays) aiming to inform individuals and groups and to encourage a certain behavior. perCues inherit properties from environmental cues in nature providing feedback about a certain aspect of the collective state guiding the individual behavior. AmI environments with perCues foster CI and persuade people to behave in a sustainable manner.

3 perCues for Sustainable Mobility

We are currently investigating the potentials of perCues applied on ambient displays in public spaces to persuade people to behave in a collectively intelligent sustainable way. The Kyoto report of Salzburg states that one third of the carbon dioxide emissions in the city are caused by traffic. Thus the authors propose to shift traffic to public mass transport [11]. One concrete scenario to reach this goal is to persuade the citizens to use public mass transportation instead of their cars. We propose the use of perCues to increase the awareness for environmental pollution and to demonstrate the effect that individual actions have on the collective situation.

Ambient displays retrieve their information from a sensor network in the environment measuring among others carbon dioxide and particulate matter. The information about these emissions is visualized in the environment. Additionally, integrated mobile devices give perCues to the individual users, e.g. when a citizen leaves the house in the morning. The perCues show the positive impact of using public transport on environmental pollution compared to using a car. A user can buy a ticket either via a ticket vending machine or via mobile phone. In both cases the decrease of emissions is visualized with perCues on public displays and on the respective device (either ticket vending machine or mobile phone). In this way a user sees the direct impact of his or her individual action, in this case buying a ticket and using the bus. Additionally the individual contributions are also presented as perCues on public displays thus informing other citizens about the environmental situation. The combination of public and private perCues gives the citizens immediate positive feedback about the behavior of other people and the positive impact their own actions. This persuades them to adapt their behaviors in line with the collective goal of reducing emissions. This leads to the emergence of a collective intelligence with the goal of increased sustainability.

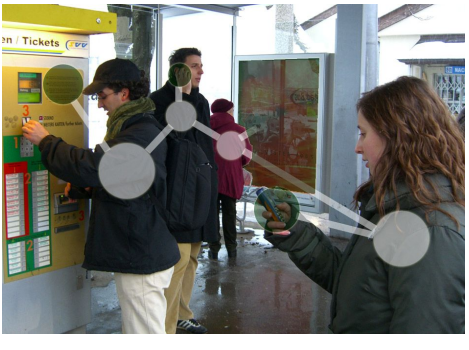


Fig. 1. Potential setting for a perCues application in a public space. The white circles indicate the individuals building a collective intelligence system through mutual awareness fostered by the perCues on the displays (dark green).

The image above (Figure 1) illustrates a possible setting for our scenario in a public space. The white circles indicate the individuals affected by the perCues on the various displays. The displays are indicated in dark green located on the ticket vending machine, mobile phones and on a large screen. The action of buying a bus ticket

by the person on the left prompts a change of the perCues. They signal how much the potential use of the bus instead of a car decreases the emissions. Using perCues in public spaces we empower the citizens to reach collectively intelligent decisions.

3 Conclusions and Future Work

perCues derived from CI are one way to design AmI environments for persuasion. The presented scenario should demonstrate the potentials of our approach. Other examples could be persuading the members of a household to save energy, to eat healthy or to learn collectively. The examples of the tiny ants and bees can show us how to reach the goal of a global collective intelligent society. Using this approach we are able to study the effects of perCues on persuasive behavior.

Acknowledgements

This research is partially funded by the Austrian Federal Ministry for Transport, Innovation, and Technology under the FIT-IT contract FFG 809532/9295.

References

1. Weiser,M. The Computer for the Twenty-First Century. Scientific American , 94-104. 1991.
2. Aarts,E., Marzano,S.: The New Everyday: Views on Ambient Intelligence. 010 Publishers, Rotterdam (2003)
3. Lorge, I., Fox, D., Davitz, J., and Brenner, M.: A survey of studies contrasting the quality of group performance and individual performance, 1920-1957. Psychological Bulletin American Psychological Assn. 55 (1958) 337-372
4. Engelbart, D., Ruilifson, J.: Bootstrapping our collective intelligence. ACM Comput. Surv. 31, ACM Press (1999) 38
5. Lévy,P.: Collective Intelligence: Mankind's Emerging World in Cyberspace. Plenum Publishing Corp., Cambridge, MA (1997)
6. Hutchins,E.: Cognition in the Wild. MIT Press, Cambridge, Mass (1995)
7. de Ruyter, B., Saini, P., Markopoulos, P., and van Breemen, A.: Assessing the effects of building social intelligence in a robotic interface for the home. Interacting with Computers 17, 5 (2005) 522-541
8. Wehner, R.: Miniaturgehirne und kollektive Intelligenz: Zur Evolution biologischer Komplexität. Zürcher Universitätsschriften 3 (2001)
9. Lawson, J.W. and Wolpert, D.H.: The design of collectives of agents to control non-Markovian systems. (2002) 332-337
10. Shirvanee, L. and Davenport, G.: The Viscous Display: a transient adaptive interface for collective play in public space. (2004) 259-263
11. Graggaber, M., Sperka, G.: Kyoto-Optionenbericht Salzburg. Expertenbericht der Arbeitsgruppe "Klimaschutz", Land Salzburg (2001)

Biofeedback Revisited: Dynamic Displays to Improve Health Trajectories

Margaret Morris

Intel Corporation
margaret.morris@intel.com

Abstract. This paper outlines an approach for prospective health technologies: systems that inspire changes in midlife to prevent onset and progression of disease. Motivational hooks related to wellness, appearance and relationship satisfaction are aligned with long term disease risks and supported through dynamic feedback displays. Wireless sensor networks, inferencing, ambient displays and mobile interfaces are explored to carry biofeedback into everyday life. Several examples of display concepts – created to facilitate self-regulation of social engagement, weight, physical exertion and stress reactivity – illustrate this approach. Future work will explore mind-body relationships and extend from informational displays to experiential feedback.

Increasing life spans and constrained medical resources have motivated a wide range of technologies to increase satisfaction and independence in later life. These developments, which leverage sensor networks and ambient displays, range from contextualized prompts for grooming, medicating and eating and to cute robotic seals that provide soothing companionship [1,2,3]. Such technologies provide much needed support to people coping with chronic diseases and other age related challenges. But a greater emphasis on prevention is needed to disrupt our overwhelmed health care system, which still focuses the vast majority of resources on acute care for the severely ill. It is estimated that seventy-five percent of national health care costs in the US, an annual total of 1 trillion, relate to the treatment of chronic diseases [4]. The chronic diseases that we now treat almost exclusively in their late stages progress slowly and predictably, as do the costs of treatment. Symptoms that are difficult and costly to treat in late stages can be stabilized and sometimes reversed if addressed early. Preventive medicine is slowly gaining momentum, and some particularly compelling approaches, such as Snyderman's "prospective care" model, illuminate how return on investiment could be increased by redistributing spending [4].

Health technologies, like the medical system, would have greater impact if more thought was given to prevention. In this paper, I propose a design strategy for "prospective health technologies" – aimed at improving health trajectories of people currently in midlife. The crux of this approach is driving behavioral change that will bring these individuals immediate benefit while lowering their long term health risks. Key elements of this approach are described, followed by examples concepts, and future directions.

W. IJsselsteijn et al. (Eds.): PERSUASIVE 2006, LNCS 3962, pp. 207 – 214, 2006.

1 Working Backwards: Mapping Common Sources

It is now popular knowledge that many chronic diseases reflect behaviors and lifestyle choices throughout life. Genetic vulnerability and environmental factors should not be overlooked, but health status at any given moment can be seen in large part as the sum of actions and reactions throughout life. New models of stress, such as Bruce McEwen's "allostatic load," illustrate the cumulative damage imposed by extended autonomic imbalance [5]. Immediate and long term health are influenced by moment to moment behaviors ranging from deliberate decisions about eating, exercising, sleeping, and socializing, to ingrained styles of regulating mood and coping with stressors.

To illustrate this approach for prospective technologies, I've heuristically sketched pathways for two very significant health conditions that typically manifest in late life – heart failure and dementia (Figure 1). The links in these pathways are not demonstrated causal relationships, but correlations that have emerged from longitudinal and retrospective studies. I highlight these two conditions because of their prevalence, costs and detriment to quality of life. Heart failure affects 5 million and costs approximately $25 billion annually in the U.S. [6]. Dementia is one of the greatest risks to independent living and is rising rapidly with the aging population. Alzheimer's disease alone now affects 4.5 million Americans, and is estimated to cost the U.S. 100 billion annually [7,8]. A growing body of literature suggests key shared vulnerabilities for heart failure and dementia: negative affectivity, stress, social isolation, and weight gain. The trajectory towards heart failure commonly proceeds from weight gain to diabetes and then coronary artery disease. Depression may moderate this progression [9]. The trajectory towards dementia appears hastened by depression, social isolation, inactivity, poor dietary choices and cardiovascular disease [7,8,10,11,12]. Health technologies can have a great impact by focusing on the commonalities in these pathways, specifically weight gain, negative affectivity, and social isolation.

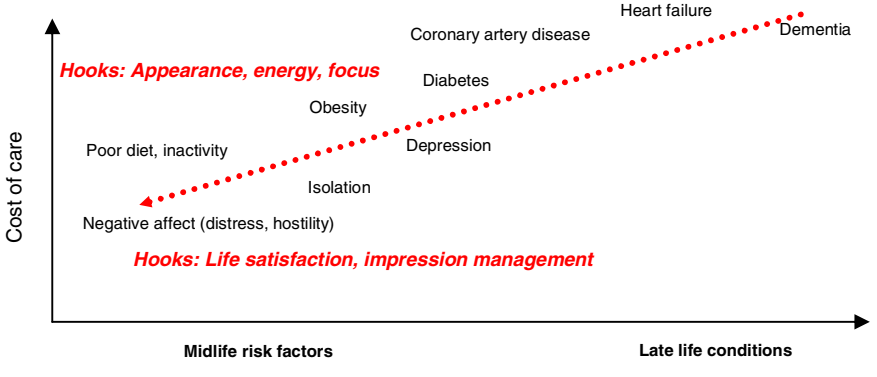


Fig. 1. Antecedents of heart failure and dementia that can be addressed in midlife. Most medical resources, and to date, health technologies, have focused on late stage conditions. This prospective approach focuses on early vulnerabilities and how those align with "hooks" – the concerns of individuals in midlife.

2 Reframing Risk: Leveraging Midlife Hooks

A key element of prospective health technology design is "meeting people where they are." These words of a master psychotherapist emphasize that clinicians need to understand the patient's perspective and his or her readiness to change. Technologists too must meet people where they are – their current concerns, values, health status, and life-stage. It is clear – from behavioral economics and our own ethnographic observations – that people generally do not forecast well. Decisions about health care and assistance in late life are often put off until a crisis, and made without the planning that would create optimal choices [13]. Technologies need to accommodate this myopic tendency by addressing present concerns – be they about appearance, relationships or mental focus – as motivating hooks that can be aligned with long term risks. For example, a 45 year old man who has slowly gained 20 lbs probably worries about attractiveness, but is less likely to calculate his body mass index relative to obesity criteria, much less his vulnerability to diabetes. Similarly, a woman prone to angry outbursts probably thinks more about the impression she makes on friends than her vulnerability to depression and ultimately cardiovascular disease. Immediate concerns about appearance and impression management, highlighted in the diagram above as "hooks," align easily with the long term costs of obesity and depression. Truly smart health technologies will support these present concerns while helping individuals avert associated long term risks.

3 Closing the Loop: Linking Assessment and Feedback

This preventive approach argued for here closes the loop between monitoring and intervention: Supportive, actionable feedback is generated from continuous assessment of behavior and physiology. In line with the approach of "embedded assessment," monitoring is woven into compensatory and preventive aids, and responsiveness to graduated cues provides nuanced data about the variability in an individual's functioning. This embedded assessment model emerged from observations that people often avoided clinical testing and diagnosis, but eagerly sought out with compensatory techniques and activities with preventive promise [14].

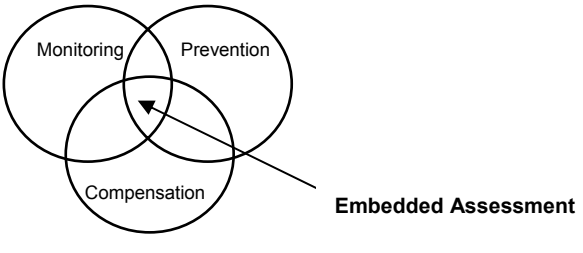


Fig. 2. Embedded assessment: Combining monitoring, prevention and compensation permits nuanced assessment and adaptive support. Model published and elaborated in [14].

An important goal in this feedback loop is to raise self-awareness and facilitate self-regulation. This goal, shared by mindfulness practitioners, is well aligned with technology miniaturization. We can now capture variability in health related data across a wide range of environments and help individuals understand and ultimately influence fluctuations in their physical and emotional states.

4 Dynamic Feedback: Presenting Context and Inspiration

To significantly influence health trajectories, we need people to make profound lifestyle changes and to maintain them over the long haul. As emphasized above, key changes include the ways people regulate their appetite, sleep, exercise, and responses to challenges. Feedback technologies will be most effective if physiology, emotion and behavior are viewed as a system [15]. In light of these goals, we need to rethink the way we reflect data and suggest change. Traditional biofeedback, which has been moderately effective in treating targeted problems such as Migraine headaches and Reynaud's disease, is a point of departure. But we need to move beyond granular depictions of muscle contractions. In particular, we need to convey context and inspiration for changing deeply ingrained behaviors.

Regarding context, new technologies are allowing us to bring therapeutic support into the environments of daily life and shape it to individuals' particular situations and needs. Specifically, wireless sensors, inference engines, and mobile interfaces can capture ecologically rich data and tailor feedback to an individual's current circumstance: where she is, her present company and activity. Some feedback is designed for on the spot assistance: Imagine a perfectly timed phone call that, based on physiological stress monitoring and sensing of kitchen environment, interrupts late night snacking. Other feedback is intended to foster self-awareness, invite goal setting and reinforce progress; such displays should reflect the convergence of contextual factors and their influence on health variables of interest (e.g., how smoking varies with social context, exercise and day of the week).

Regarding inspiration, feedback should suggest fluidity in mental and physical states. Studies on cognitive behavioral therapy and mindfulness practices have demonstrated the value of illuminating the changeability of negative situations [16,17]. Sensor technologies and inference engines are well suited to capturing variability. But we need to think carefully about how to display variability in a way that empowers change. In doing so, it is important to show individuals immediate evidence of their actions and allow them to conduct empirical experiments. Lagging indicators of behaviors that accrue over months, such as weight scale readouts, are often counterproductive. Pedometers by contrast, offer appeal of immediate feedback. Glucometers similarly allow immediate empirical evaluation -- a characteristic that has been leveraged in games designed for children [18,19]. Experimentation could be invited on a larger scale, relating for example, to social roles and styles and of reacting to stressors.

5 Example Displays

Following are display concepts intended to motivate behavioral change and prevent disease progression. These concepts vary in stage of development. The first ambient display has been fully integrated with a wireless platform and tested over months in the homes of elders and caregivers. The second and third are preliminary concepts for reflecting cardiovascular and weight changes to individuals with chronic conditions. The last is an exploratory sketch intended to convey the maladaptive dynamics of extended stress reactivity.

A Solar model of social engagement (Figure 3, see [20] for full description)**.** This display reflects data on co-present and phone interaction gathered from wireless sensor networks. We tested this display and platform of sensors and interventions with older adults at risk of isolation and associated problems, such as dementia. The elder, represented as the sun, is surrounded by planetary representations of friends and family who move inward with greater contact. The display was designed to raise awareness of social health as a dynamic and controllable aspect of well-being.

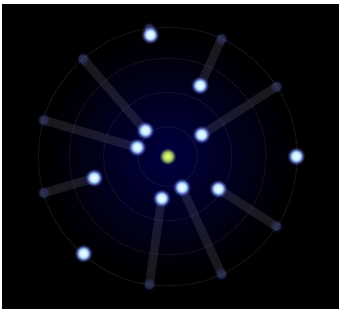


Fig. 3. A Solar model of social engagement

Removing shame from the scale (Figure 4)**.** This display of weight trends was inspired by studies of heart failure patients. Sudden weight gain reflects dangerous fluid retention that can be reversed through diuretic medications. But many avoid the

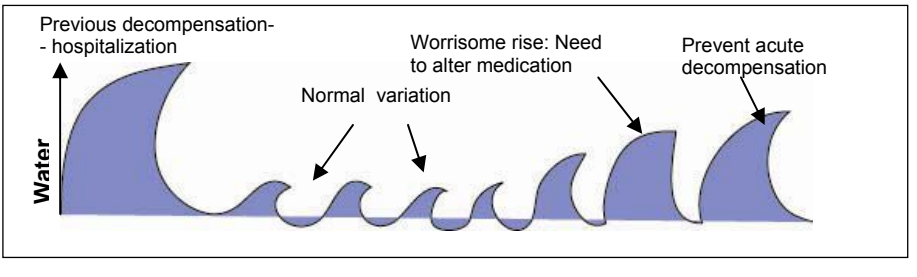


Fig. 4. Removing shame from the scale

scale. As one cardiac nurse explained, “No one, not even my male 80 year old, severely obese, late stage heart failure patients want to confront weight gain.” Water retention is here depicted as rising tides, distinguished from base weight. Patients can see the levels associated with a previous decompensation and normal variation. When levels rise above a threshold, the display also suggests need for corrective action.

Motivating safe exercise. This display, also inspired by studies of heart disease, concepts plots of activity levels against cardiovascular stress (Figure 5). Exercise holds long term benefit but is sometimes avoided due to short term risks associated with exertion. For this concept, activity and cardiovascular monitoring are embedded in a wireless earpiece. Feedback of current state and trends is presented on the screen of a mobile phone. In the example display, blooming flowers accompany the graphically depicted trend of increased activity and decreased cardiovascular stress. This prototype is being developed with Intel colleague Farzin Guilak.

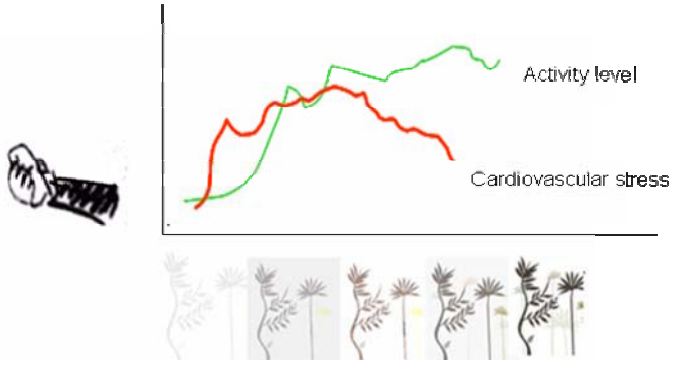


Fig. 5. Motivating safe exercise

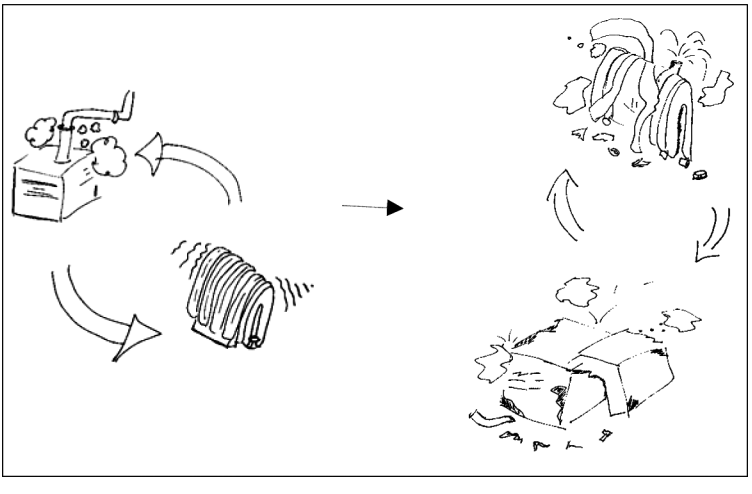


Fig. 6. Remodeling stress

Remodeling stress. This sketch (Figure 6), developed in collaboration with Bruce McEwen, is intended to convey the concept of "allostatic load" [5]. Extended autonomic imbalance is depicted metaphorically as an inefficient heating and cooling system . Blasting air conditioning over a heater on a warm spring day may produce an acceptable temperature in the short term, but will wear down the building over time. This deterioration represents the cumulative toll of stress reactivity on immune function and many aspects of health.

6 Future Directions

Prospective care will be greatly enhanced by collaborations between health and technology researchers on novel forms of feedback. The examples shared in this paper, and I believe most other feedback tools created to date, have focused on either physiology or behavior. The most important and challenging work will, as Schwartz suggested early on, explore the interplay of behavior, emotion and physiology [15]. We now have the tools to gather data in many contexts of life and make more informed inferences about these relationships. Some of the most challenging work will lie in determining the interventions or feedback approaches most effective in motivating change. Ongoing translation between what can be measured and what is meaningful for individuals will certainly be important. There will also be exciting opportunities to personalize and tailor messaging. Migrating therapy into everyday life holds great potential for interrupting the behaviors that are described but rarely demonstrated in clinical interactions. But to be effective, this "mobile therapy" needs to be as compelling as a cigarette, drink, donut, a hostile outburst, or ruthless self-criticism. Given the immediate pull of such stimuli and reactions, we must broaden the exploration of feedback from informational displays to experiential support.

Acknowledgements. This work is conducted within Intel's Health Research Innovation group. The examples were developed with current and former colleagues at Intel particularly designers Janna Kimmel, Jason Cassezza, Wendy Ju, and bioengineer Farzin Guilak. I also thank Professor Larry Jamner for his thoughtful reviews on this paper.

References

1. Pollack, M. E.: Intelligent technology for an aging population: The use of AI to assist elders with cognitive impairment. AI Magazine, 26 (2005) 9-24
2. Mihailidis, A.; Fernie, G.: Context-aware assistive devices for older adults with dementia. Gerontechnology, 2 (2002) 173-189
3. Shibata, T.: An overview of human interactive robots for psychological enrichment. Proceedings of the IEEE, 92 (2004) 1749-1758
4. Snyderman, R.; Sanders Williams: Prospective Care: The next health care transformation. Academic Medicine 78 (2003) 1009-1084
5. McEwen, B.: The End of Stress as We Know It. National Academies Press (2002)
6. www.HFSA.org

7. Hebert, L.E.; Scherr, P.A.; Bienias, J.L.; Bennett, D.A.; Evans, D.A.: Alzheimer disease in the U.S. population: Prevalence estimates using the 2000 census. Archives of Neurology 60 (2003) 1119 – 1122
8. Ernst, R.L.; Hay, J.W. The U.S. economic and social Costs of Alzheimer's Disease Revisited. American Journal of Public Health. 84 (1994) 1261 – 1264
9. Kramer, P. Against Depression. Viking Penguin (2005).
10. Fratiglioni, L.; Wang, H.; Ericsson, K.; Maytan, M.; and Bengt, W. Influence of social network on occurrence of dementia: A community-based longitudinal study. The Lancet, 355 (2000) 1315-1319
11. Cole, G. et al. Docosahexaenoic acid protects from dendritic pathology in an Alzheimer's disease mouse model. Neuron. 43 (2004) 633-645
12. Larson E.B.; Wang L.; Bowen J.D.; McCormick, W.C.; Teri, L.; Crane, P.; Kukull, W. Exercise is associated with reduced risk for incident dementia among persons 65 years of age and older. Ann Intern Med., 144 (2006) 73–81
13. Morris, M.; Lundell, J.; Dishman, E.; Needham, B.: New perspectives on ubiquitous computing from ethnographic studies on cognitive decline. Proc. Ubiquitous Computing (UbiComp 03), A.K. Dey, A. Schmidt, and J.F. McCarthy, eds., Springer-Verlag (2003) 227–242
14. Morris, M.; Intille, S.; Beaudin, J.: Embedded health assessment. Pervasive, 2005. Springer Verlag (2005) 333-346
15. Schwartz, G.: The brain as health care system. Health Psychology (1979) 549-571
16. Seligman, M.E.; Seligman, M.E.P.: Explanatory style: Predicting depression, achievement, and health. In: Brief Therapy Approaches to Treating Anxiety and Depression, M.D. Yapko, ed., Brunner/Mazel (1989) 5–32
17. Langer, E.: Mindfulness, Perseus Books (1989)
18. Kumar, V.S. et al.: The DAILY trial: A wireless portable system to improve adherence and glycemic control in youth with diabetes. Diabetes Technology and Therapeutics, 6 (2004) 445–453
19. Turkle, S. Personal communication
20. Morris, M. Social networks as health feedback displays. IEEE Internet Computing, vol. 09, no. 5, (2005) 29-37

Author Index