Influencing Individually: Fusing Personalization and Persuasion Extended Abstract

Shlomo Berkovsky[*], Jill Freyne[*], Harri Oinas-Kukkonen[#]
[*] Digital Productivity Flagship, CSIRO, Australia
firstname.lastname@csiro.au
[#] Department of Information Processing Science, University of Oulu, Finland
harri.oinas-kukkonen@oulu.fi

Abstract[1]

Personalized technologies aim to enhance user experience by taking into account users' interests, preferences, and other relevant information. Persuasive technologies aim to modify user attitudes, intentions, or behavior through computer-human dialogue and social influence. While both personalized and persuasive technologies influence user interaction and behavior, we posit that this influence could be significantly increased if the two are combined to create *personalized and persuasive* systems. For example, the persuasive power of a one-size-fits-all persuasive intervention could be enhanced by considering the user being influenced and their susceptibility to the persuasion being offered. Likewise, personalized technologies could cash in on increased successes, in terms of user satisfaction, revenue, and user experience, if their services used persuasive techniques.

1 Introduction

In an effort to alleviate the pressure placed on information seekers in trawling through the abundant resources available online, the advent of *personalized* information services has come about. These services aim to enhance user experience and assist users in achieving their goals by taking into account their interests and preferences, as can be seen in search engines, social applications, navigation support tools, and many other applications [Mobasher et al., 2000; Brusilovsky et al., 2007]. *Persuasive* technologies attempt to shape, reinforce or change behaviors, feelings, or thoughts about an issue, object, or action. This can be achieved through software support for carrying out tasks, computer-human dialogue, credible advice, or social influence [Fogg, 2003; Oinas-Kukkonen and Harjumaa, 2009]. Persuasive technologies provide new abilities that make a desired behavior easier to achieve, simulate compelling experiences to effectively persuade users, or create relationships through a variety of cues to establish trust and support a desired change. These technologies are often exploited to persuade users to maintain a healthy lifestyle, to be environmentally friendly, or to purchase certain products.

Although both personalized and persuasive technologies aim to influence user interactions or the users themselves, little has been done in either area on incorporating techniques proven to work in the other. Most persuasive applications employ a one-size-fits-all approach to the delivery of persuasive interventions, failing to deliver personalized persuasion that leverages user characteristics and preferences, or to provide personalized tools that assist users in achieving the intended goals. Personalized technologies use sophisticated modeling and understanding of user preferences to provide personalized services, but fail to cash in on increased successes that could potentially be achieved, if their services were supported by persuasive communication.

The implementation of *personalized and persuasive technologies* would enhance the impact of either technology applied in isolation. Personalized systems would benefit from incorporating persuasive techniques to gather valuable user information, increase uptake of recommendations, and improve the quality of service and the overall user experience. Persuasive systems could adapt the type and intensity of the persuasive interventions to the preferences and characteristics of each individual user, thus, upgrading their persuasive capabilities. We propose that the impact of the combination of these technologies would exceed the impact currently seen by them applied independently, and predict an increased interest in investigating their fusion from both research communities [Berkovsky et al., 2012].

2 Personalization to Enhance Persuasion

According to [Oinas-Kukkonen, 2010], behavior change support systems are the primary focus of research in the area of persuasive technologies. Persuasive technologies convey persuasive interventions through carefully chosen language, interface, and modality to influence users' behavior and per-

[1] This paper is an extended abstract of the ACM TiiS publication [Berkovsky et al., 2012].

ceptions, such that different strategies may be applied by persuasive systems to support different outcomes and behavior changes. A key challenge, in particular for mass persuasion, is that often the target audiences are large and heterogeneous, and include users with wide ranging goals, needs, and preferences. Thus, influencing the entire audience effectively with a one-size-fits-all persuasive intervention is difficult [Masthoff et al., 2014; Orji et al., 2014].

The persuasive research community is aware of the potential of adaptation and tailoring, as illustrated through the use of names in communication, adaptation to user input, and delivery of tailored feedback [Fogg, 2003]. In addition to these strategies, we propose that user information could be exploited to personalize the persuasive interventions, so that the message conveyed, the interface used, or the timing of the intervention are personalized to the user being targeted. The proposed fusion of persuasion and personalization encourages the use of deeper user modeling and personalization techniques throughout the persuasion process. Table 1 shows different roles that can be taken by persuasive technologies and ways to personalize these.

Tool: increases user capability to achieve goals by:	Medium: provides compelling experience by:	Actor: creates social relationship with users by:
- monitoring progress of parameters important to user - providing contextualized and personalized suggestions - adapting textual feedback: content, mode, language, method, delivery, interface	- showing personalized cause-and-effect scenarios - facilitating realistic simulations for each user - predicting future user activities - providing personalized simulated objects	- providing personalized language cues - tailoring interaction to user's cultural diversity - adapting relationships to user's social circle - facilitating service tailored to user's behavioral norms

Table 1: Fusion of personalization in persuasive technologies

2.1 Strengthening the Impact of Persuasion

We discuss three natural opportunities for personalization in persuasive systems: (i) personalized assistive features focus on monitoring and presenting information about aspects of importance to a user; (ii) personalized messages tailor the content and the look-and-feel of the information in order to meet users' communication preferences; and (iii) personalized strategies focus on responding to a user's susceptibility to various persuasive techniques and methods.

Personalized *assistive features* of persuasive systems may act as facilitators that assist users in achieving their goals in an easy and simple manner. Persuasive systems are often unresponsive to the preferences of the users and fail to monitor progress with respect to parameters that are important for them. By incorporating personalization, which understands the desired change and adaptively supports the user in achieving this change, the persuasive power of the system could be leveraged. They could monitor on users' behalf, provide guidance and support, or even provide encouraging personalized feedback. An example of such tools would be a personalized exercise planner in a persuasive fitness application [Lin et al., 2014]. The planner would recommend a fitness routine, which considers the fitness level, injuries, exercise preferences, location, and weather, with the aim of generating a plan that is appealing to and achievable for that user.

Personalized *messages* offer a powerful form of communication. These can enrich persuasive systems through adaptive delivery of the interventions, which reflect the preferences of the individual using the system. The language, modality, font, layout, and many other characteristics of the messages can be personalized, allowing users to relate more to the information, service, and persuasive technique being used. In addition, the content displayed to an individual can be adapted to a user's preferences, tailored to the observed contextual conditions, and certain information can be highlighted or removed. The information can be delivered at appropriate times (morning, evening), through the most appropriate medium (email, SMS), and according to the preferred frequency (daily, weekly) [Brindal et al., 2013]. The above exercise planner could deliver its recommendations through contextualized just-in-time messages, supported by appropriate language, visual style, and multimedia content.

A core area, which has been thus far under-investigated, is that of personalized *persuasive strategies*, where the type of intervention itself is adapted to a user's personality, behavior, and susceptibility to various forms of persuasion [Hirsh et al., 2012]. We posit that this personalization has a huge untapped potential to maximize the impact of persuasive applications. There are multiple dimensions that the exercise planner could potentially personalize in this scenario, like the credibility of the information sources, tone and style of the intervention, inclusion of animated avatars, or application of authoritative language, to name a few.

2.2 Practical Examples

There are relatively few research studies, which successfully incorporate personalized techniques or features into persuasive systems. [Dijkstra, 2006] studied the impact of personalized smoking cessation messages, which gave smokers personalized feedback on their smoking. The system provided to users generic information on the dangers of smoking and personalized information pertaining to their smoking habits. After completing a computerized questionnaire, one cohort of smokers was presented with the generic information, while another with personalized information. The results showed that after four months, the personalized feedback led to significantly higher levels of smoking cessation than standard non-personalized feedback. In this case, the persuasive power of the information presented to users was increased by adapting the presented information according to level of smoking reported by each individual.

The physical activity motivating game design is a persuasive gaming concept that leveraged enjoyment of computer games to encourage players to perform mild physical activity while playing [Berkovsky et al., 2010]. The

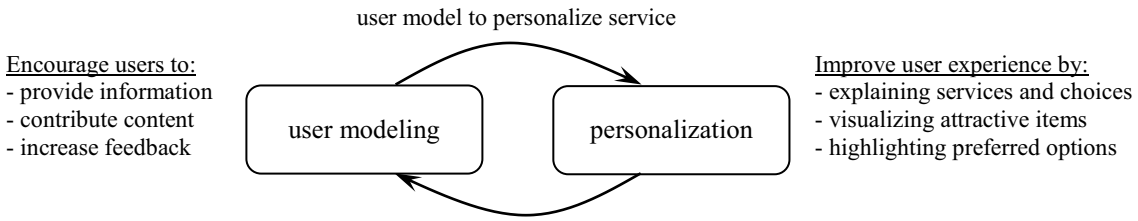

Figure 1: Fusion of persuasion in personalized technologies

design persuaded users to perform physical activity by making the game more difficult and offering virtual in-game rewards in return for activity. Initial evaluations showed that the persuasiveness of the design (in terms of triggering activity) was related to players' gaming skills, such that better players performed less activity. Thus, a personalized application of the design was developed, which adapted the difficulty of the game to a player's skills, in order to stabilize the persuasive power of the games. This successfully balanced the amount of activity performed by various players without affecting their willingness to be persuaded. The use of personalization in this case showed how responding to the characteristics of individual users leveraged the impact of a persuasive application.

[Nguyen et al., 2007] investigated the connection between a persuasive argument and the characteristics of the users being persuaded. They developed models for the discrepancy between a user's and an arguments position, the strength of the argument for the user, and the user's involvement with the topic of the argument. Users were modeled through a set of sample arguments, which they were asked to rate. The evaluation showed that modeling was an important step towards accurately predicting the users' response to an argument and that it should be applied when selecting the most appropriate argument to be presented by a persuasive system. The personalized selection of arguments streamlined the persuasion task and made the desired behavior or attitude easier to achive.

3 Persuasion to Enhance Personalization

The aim of personalized applications is to provide relevant information or services to users based on their preferences and needs. Personalization often takes place in recommender systems, information filtering and retrieval systems, directed Web navigation, e-learning platforms, shopping assistants, and many other online services [Brusilovsky et al., 2007]. Personalized systems build and sustain user trust and loyalty through the provision of intelligent support adapted to user requirements.

The personalization cycle can be broadly divided into two components: user modeling and personalized service delivery. The former focuses on the mining and extraction of the required user information from observed interactions with the system. The latter focuses on the development of accurate personalization algorithms and provision of the actual service to users. Figure 1 illustrates the personalization cycle, the information exchanged between the two components, and the ways, in which we suggest its enhancement through persuasive technologies.

3.1 Increasing the Uptake of Personalization

The key fusion points for persuasion in personalized systems lie in the functional areas, which we denote by persuasive user experience and persuasive data acquisition.

The most general way in which persuasion could be included in a personalized system is through the information, language, media, and communication modes used by the system. Persuasive use of attractive avatars, praise, and humorous language will improve *user experience* and the users will be more likely to use the system again [Knijnenburg et al., 2012]. To establish and sustain user enjoyment, designers of personalized systems have to consider the power of the social role, which has been successfully investigated in the persuasive research. In addition, personalization systems may benefit from explaining to users the reasoning behind the recommended or filtered items, or the suggested information. Explaining to users the system's behavior builds up trust, which, in turn, increases both user loyalty and the uptake of the services. For example, consider a personalized recommender system deployed by an eCommerce Web site. The recommender would exploit persuasive technologies to explain the recommendations and make them look more attractive, thus, increasing their uptake [Tintarev and Masthoff, 2011].

Personalized search engines, navigation aids, learning tools, and recommender systems require accurate information pertaining to their users, in order to provide personalized services. This information can take the form of explicitly provided user data or implicit data learned from the observed user interactions. Acquiring rich and reliable user information has been a major challenge for many personalized technologies. We propose that persuasion could be used to encourage users to provide more information, alleviating the *data acquisition* challenge. The use of persuasive language, praise, and rewards can encourage users to provide more information. Persuasive tools, such as monitoring, reminders, and suggestions, can play an important role in increasing the amount of content contributed by users, especially in social media applications [Vassileva, 2012]. In addition, the persuasive power of simulated scenarios can be leveraged to demonstrate quality

enhancements that could potentially be achieved, if more user information was available to the system. The above mentioned eCommerce recommender would ask users to rate the purchased items or offer them to answer questions posted by other users, in order to learn their preferences and encourage contribution of user-generated content.

3.2 Practical Examples

Works on the persuasive nature of personalized systems have become popular as the research into the interaction, presentation, and user interfaces of personalized systems has attracted increased attention. While the label of persuasion has not been attached to many works, they often focus on enticing users to provide information and take up recommendations, which are clear persuasive tasks.

[Herlocker et al., 2000] examined the compelling nature of textual explanations supporting recommendations in movie recommender systems. They evaluated in a live user study 21 variants of explanations, ranging from algorithm-specific to domain-specific information. The most influential or persuasive explanations were discovered to contain visual representations of information about the ratings of like-minded users, information on past accuracy of the recommendations provided by the system, similarity of the recommended movie to other movies already seen by the user, and information on the presence of the user's favorite actors in the movie. These are all visual cues that convey persuasive messages, which explain the nature of the recommendations and increase user trust.

[Farzan and Brusilovsky, 2009] investigated the use of persuasive cues in a personalized navigation support system. This work evaluated the role of visual social cues (icons representing reading and annotation by other users) in persuading users to take up recommendations for relevant documents and, thus, simplify their navigation. It was discovered that showing cues relating to the actions of other users in the community successfully affected user behavior and that users followed these cues when seeking for relevant information. The results were discovered to depend on user factors (degree of trust) and on contextual factors (time availability), which affected the perceived usefulness or persuasiveness of the cues. In this example, the inclusion of visual persuasive cues affected the uptake of services provided by a personalized navigation support system.

[Felfernig et al., 2007] proposed that the presentation of recommended items and the presence of other items influenced user choices of the recommendations. They analyzed the position and decoy effects in recommendation lists and their impact on the persuasiveness of the recommended items. The evaluation showed that the perceived utility of a recommended item changed in the light of the surrounding items and that position effects were important for item comparison pages. Specifically, the appeal of items changed when similar, but better-value or higher-specification items were shown. They investigated methods to determine the ordering and decoy strategies that could effectively persuade users to consume a recommended item. Thus, including decoy items in recommendation lists can be considered a persuasive strategy aimed at boosting the attractiveness of target recommended items.

4 Discussion

The potential impact of fusing personalized and persuasive technologies is tremendous. However, their fusion also raises a number of technological, methodological, and ethical issues, which can influence the uptake of this fusion and drive future research in this area.

Emerging opportunities. Most existing online persuasive strategies are digital reflections of well-established offline strategies studied in behavioral research. However, Web-based and mobile environments offer a cardinally new paradigm and opportunities for new persuasive research. For example, social networking systems offer opportunity to persuade through strong and weak ties [Freyne et al., 2010]. How can the online context provide opportunities to novel online persuasive strategies for personalized persuasion?

User modeling. The user modeling process, which is required to realize personalized persuasive strategies, is a challenging task. The construction of persuasion-related user models requires explicit information about user susceptibility to various forms of persuasion. This information is not readily available and is unlikely to be successfully learned from the implicitly observed system interactions [Kuflik et al., 2009]. How do we progress in effectively gathering user modeling data that can facilitate the provision of accurate personalized persuasion?

Impact of personalization. The impact of personalization applied to persuasive technologies may differ across various platforms, persuasive tasks, and application domains. Different domains and tasks imply different levels of trust, privacy constraints, and user sensitivity to exposure to persuasion. Also, the evaluation should ultimately address longitudinal behavior and attitude changes rather than a short-term impact [Latulipe et al., 2011]. How can the impact of the application of personalization be evaluated and analyzed in application- and domain-agnostic manner?

Ethical issues. The introduction of personalized persuasion can lead to an ethical dilemma, as user requirements may conflict with a system designer's intentions, in particular in commercial applications [Fogg, 2003]. For example, the primary goal of eCommerce sites is to increase sales and revenues, whereas the users are interested to purchase products reflecting their needs and abilities. How can we balance what is best for the user and the commercial realities facing the service provider when delivering personalized persuasive interventions?

In summary, the fusion of persuasion and personalization is a highly promising and appealing area for both scientific research and practical design. More works on the intersection of the two areas have appeared in the recent years, and we foresee an increased interest in the topic. Hence, we would like to invite academics and practitioners to elaborate these ideas and help us advance this emerging field with influential and targeted solutions.

References

[Berkovsky et al., 2010] Shlomo Berkovsky, Jill Freyne. Mac Coombe, and Dipak Bhandari. Recommender Algorithms in Activity Motivating Games. In *Proceedings of the ACM Conference on Recommender Systems*, pp. 175-182, 2010.

[Berkovsky et al., 2012] Shlomo Berkovsky, Jill Freyne, and Harri Oinas-Kukkonen. Influencing Individually: Fusing Personalization and Persuasion. *ACM Transactions on Interactive Intelligent Systems*, 2(2):9, 2012.

[Brindal et al., 2013] Emily Brindal, Gilly Hendrie, Jill Freyne, Mac Coombe, Shlomo Berkovsky, and Manny Noakes. Design and Pilot Results of a Mobile Phone Weight-Loss Application for Women Starting a Meal Replacement Programme. *Journal of Telemedicine and Telecare*, 19(3):166-174, 2013.

[Brusilovsky et al., 2007] Peter Brusilovsky, Alfred Kobsa, and Wolfgang Nedjl. *The Adaptive Web: Methods and Strategies of Web Personalization*. Springer Publishing, 2007.

[Djikstra, 2006] Arie Dijkstra. Technology Adds New Principles to Persuasive Psychology: Evidence from Health Education. In *Proceedings of the Persuasive Technology Conference*, pp. 16-26, 2006.

[Farzan and Brusilovsky, 2009] Rosta Farzan and Peter Brusilovsky. Social Navigation Support for Information Seeking: if you Build it, will they Come? In *Proceedings of the International Conference on User Modeling, Adaptivity and Personalization*, pp. 66-77, 2009.

[Felfernig et al., 2007] Alexander Felfernig, Gerhard Friedrich, Bartosz Gula, Martin Hitz, Thomas Kruggel, Gerhard Leitner, and Rudolf Melcher. Persuasive Recommendation: Serial Position Effects in Knowledge-Based Recommender Systems. In *Proceedings of the Persuasive Technology Conference*, pp. 283-294, 2007.

[Fogg, 2003] BJ Fogg. *Persuasive Technology: Using Computers to Change What we Think and Do*. Morgan Kaufmann Publishers, 2003.

[Freyne et al., 2010] Jill Freyne, Shlomo Berkovsky, Elizabeth Daly, and Werner Geyer. Social Networking Feeds: Recommending Items of Interest. In *Proceedings of the ACM Conference on Recommender Systems*, pp. 277-280, 2010.

[Herlocker et al., 2000] Jonathan L. Herlocker. Joseph A. Konstan, and John Riedl. Explaining Collaborative Filtering Recommendations. In *Proceedings of the ACM Conference on Computer Supported Collaborative Work*, pp. 241-250, 2000.

[Hirsh et al., 2012] Jacob B. Hirsh, Sonia K. Kang, and Galen V. Bodenhausen. Personalized Persuasion: Tailoring Persuasive Appeals to Recipients' Personality Traits. *Psychological Science*, 23(6):578-581, 2012.

[Knijnenburg et al., 2012] Bart P. Knijnenburg, Martijn C. Willemsen, Zeno Gantner, Hakan Soncu, and Chris Newell. Explaining the User Experience of Recommender Systems. *User Modeling and User-Adapted Interaction*, 22(4-5):441-504, 2012.

[Kuflik et al., 2009] Tsvi Kuflik, Shlomo Berkovsky, Francesca Carmagnola, Dominik Heckmann, and Antonio Krüger. *Advances in Ubiquitous User Modeling*. Springer Publishing, 2009

[Latulipe et al., 2011] Celine Latulipe, Erin A. Carroll, and Danielle Lottridge. Evaluating Longitudinal Projects Combining Technology with Temporal Arts. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, pp. 1835-1844, 2011.

[Lin et al., 2014] Yu-Feng Lin, Cheng-Hao Chu, Bo-Hau Lin, Yi-Ching Yang, Miin-Luen Day, Shyh-Chyi Wang, and Kuen-Rong Lo. A Framework for Personalized Diet and Exercise Guideline Recommendation. In *Technologies and Applications of Artificial Intelligence*, pp. 274-283. Springer Publishing, 2014.

[Masthoff et al., 2014] Judith Masthoff, Floriana Grasso, and Jaap Ham. Preface to the Special Issue on Personalization and Behavior Change. *User Modeling and User-Adapted Interaction*, 24(5):345-350, 2014.

[Mobasher et al., 2000] Bambshad Mobasher, Robert Cooley, and Jaideep Srivastava. Automatic Personalization Based on Web Usage Mining. *Communications of the ACM*, 43(8):142-151, 2000.

[Ngugen et al., 2007] Hien Nguyen, Judith Masthoff, and Peter Edwards. Modelling a Receiver's Position to Persuasive Arguments. In *Proceedings of the Persuasive Technology Conference*, pp. 271-282, 2007.

[Oinas-Kukkonen and Harjumaa, 2009] Harri Oinas-Kukkonen and Marja Harjumaa. Persuasive Systems Design: Key Issues, Process Model, and System Features. *Communications of the Association for Information Systems*, 24:485-500, 2009.

[Oinas-Kukkonen, 2010] Harri Oinas-Kukkonen. Behavior Change Support Systems: A Research Model and Agenda. In *Proceedings of the Persuasive Technology Conference*, pp. 4-14, 2010.

[Orji et al., 2014] Rita Orji, Julita Vassileva, and Regan L. Mandryk. Modeling the Efficacy of Persuasive Strategies for Different Gamer Types in Serious Games for Health. *User Modeling and User-Adapted Interaction*, 24(5):453-498, 2014.

[Tintarev and Masthoff, 2011] Nava Tintarev and Judith Masthoff. Designing and Evaluating Explanations for Recommender Systems. In *Recommender Systems Handbook*, pp. 479-510. Springer Publishing, 2011.

[Vassileva, 2012] Julita Vassileva. Motivating Participation in Social Computing Applications: a User Modeling Perspective. *User Modeling and User-Adapted Interaction*, 22(1-2):177-201, 2012.