

# Personalized Persuasion: Addressing Target Behavior, Persuadability and Persuasive Agents within PEACOX

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## ABSTRACT

Personalization is expected to increase the efficiency and impact of persuasive systems. In this workshop paper we present three different approaches that we have used to personalize a persuasive advisor for cross-modal trip planning. We report details of our approaches and discuss lessons learned based on our experiences during development as well as during the field trials of the system.

## Author Keywords

Persuasion; persuadability, personalization; travel mode choice.

## ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI):  
Miscellaneous.

## INTRODUCTION

Persuasive interfaces have been proposed and used to influence people's behavior and attitudes within the past couple of years. However, research found that such systems typically only result in small effects [e.g. 3], and that approaches which increase the effectiveness of persuasive systems are needed. A promising possibility to increase the impact of persuasive systems is to personalize and tailor the system concept, design and interventions to the individual user [1]. Even though personalization in persuasion has been suggested frequently, only few systems actually implemented personalization mechanisms, and limited empirical data on their effectiveness is available. Also, the theoretical foundations of personalized persuasion are still in its beginnings, and more basic research into different aspects of behavior change and persuasion is needed.

In this paper we present three different personalization elements of persuasive systems research within the

PEACOX (Persuasive Advisor for CO<sub>2</sub>-reducing cross-modal trip planning) project. PEACOX aims at motivating people to use more ecologically friendly modes of transport by use of a smartphone app that supports the user in ecologically optimized route finding and provides feedback and persuasive nudges towards more ecological behavior. To this end, PEACOX provides travelers with personalized multimodal navigation tools. The presentation of different rout options considers the current location of the users, their current travel situation, their individual preferences as well as their current mode of transport and past travel behavior. PEACOX automatically keeps track of the users prior travel decisions and routes (by use of GPS and automated travel mode detection), identifies the current mode and purpose of a trip, and builds tailored models for each user. Furthermore PEACOX calculates the ecological/carbon footprint considering the used means of transportation as well as dynamic variables influencing the actual emissions, such as current traffic situation.

Personalization as a means to increase the efficiency of the persuasive approach is addressed within the project on three levels: First, the target behavior that is proposed in persuasive suggestions for behavior change is tailored to an approximation of the individual users' range of acceptable travel alternatives. Second, within the project we developed methods to estimate the persuadability and susceptibility to different persuasive strategies of users, thereby enabling us to select the most appropriate strategy for each type of users. Third, we started to analyze the influence and effectiveness of different persuasive agents (i.e. the way a message is communicated) in order to further personalize and individually target persuasive interventions.

In the following sections we describe the mentioned personalization efforts in more detail and discuss them with regard to lessons learned and further development directions.

## PERSONALIZATION OF TARGET BEHAVIOUR

Many persuasive strategies use suggestions of alternative behavior to influence people towards more sustainable options. In the case of travel behavior for example the goal is to persuade users to choose transportation alternatives that produce less CO<sub>2</sub>. Walking or biking would fit the bill, however a successful system must also consider situational and individual factors in selecting alternative behavior

suggestions in order to increase the likelihood of the users to actually follow the suggestions. In PEACOX we use two different mechanisms in order to address this problem: a detailed analysis and definition of user groups and a good understanding of the users' current context.

Within PEACOX we identified relevant user groups and clusters of users with similar travel behavior patterns and information needs. Special focus was placed on aspects related to characteristics considered especially relevant and decisive for travel behavior. Next to socio-demographical factors we differentiate users on a continuum of environmentalism, of psychological variables and context/situational variables. We analyzed existing literature [e.g. 4,5] which deals with the classification of users and user groups and also researched other projects dealing with similar topics and segmentation methods, and finally a tailored user classification was developed. This classification now is used to decide (together with the context analysis) which alternative suggestions are made to the users. For example, 'car enthusiasts' [4] are not presented with suggestions for long bike trips.

Another important aspect for PEACOX is the tailoring of persuasive interventions based on understanding of the users travel context and preferences. This understanding is based on automated trip mode detection and trip purpose imputation. Trip mode is analyzed using GPS and map data, and works already sufficiently. In an example trial accuracy of around 83% could be achieved [6]. This increased understanding of the users' actual context now can be used to optimize the systems suggestions towards the user. For example, as the system knows when the user is driving in a car it will adapt recommendations accordingly.

Trip purpose imputation uses activity and location (both person related and general) as input parameters to detect basic types such as home, work/education or shopping. Accuracy of detection is not as reliable as for the trip mode [7]. However, even not perfect data is an improvement over no knowledge on the users' intention, and can be used to increase the chances to provide suggestions that are useful and acceptable for the end user.

#### **PERSUADABILITY AND SUSCEPTIBILITY TO DIFFERENT PERSUASIVE STRATEGIES**

To create personalized persuasive technology it is also helpful to be able to estimate the susceptibility of a person to different persuasive strategies (persuadability) - this also has been referred to as "Persuasion Profiling" [1]. In order to improve the design of persuasive technology, we developed and initially validated scales to measure persuadability for selected persuasive strategies for which specific psychometric inventories do not exist yet [2]. The successfully developed scales (for the persuasive strategies *rewards*, *competition*, *social comparison*, *trustworthiness* and *social learning*) can now be used to estimate users' susceptibility to certain persuasive strategies. Designers of

persuasive technology can identify their intended user groups and use the questionnaires to extract the most effective persuasive strategies to be incorporated in the technology.

We now are working on detailed possibilities to include this knowledge in the actual system design, and how to specifically design system components that utilize different styles of persuasion. Here we currently are focusing on different possibilities to frame messages e.g. by using authoritative statements versus statements referring to social comparisons, and are researching whether this different framing actually results in differences in compliance to suggestions or perceived appropriateness.

We currently also are working on possibilities to identify the users susceptibility for different strategies based on observable behavior, so that there is no need to have to bother users with intrusive questionnaires but have the possibility to adapt the used strategies based on available behavior observations rather than on explicit user statements.

#### **EFFECTIVENESS OF PERSUASIVE AGENTS**

Suggestions and feedback on behavior are central elements of several persuasive strategies. Suggestions and feedback information can be designed along different dimensions and can be communicated in very different ways and by use of different media to the user. For example, suggestions may vary in their content (e.g. specific vs. general, emotional vs. logical, etc.), be delivered as text, graphical or audio messages, and can be presented as animations or by embodied agents.

Within PEACOX we are now researching the effects of the type of persuasive agent used on the effectiveness of the overall system. Prior research in related areas has shown that different people react differently towards different presentation styles. For example, importance of mapping learning materials to learning styles has been identified as an important possibility to increase efficiency of training, see Coffield et al. [8] for a critical review of learning styles and their role in pedagogy. Also, in prior work we identified important influences of personality traits (especially introverts vs. extroverts) on the perception of embodied agents [9]. We therefore think that similar effects can be expected to apply in the context of persuasive systems.

In order to better understand the role of the persuasive agent we now address the following questions in our research:

- What kind of persuasive agent (e.g. embodied agent, cartoon-like agent, text message) is more effective in which type of persuasive situations, and what factors influence the effectiveness and acceptance of a persuasive system?

- Does the appearance of an embodied persuasive agent (e.g. male-neutral-female, old-young, etc.) have an significant influence on the willingness to comply to persuasive requests? Here we specifically expect that

certain combinations of persuasive strategies and persuasive agent work better than others. For example, in the case of an authoritative strategy an older male ‘expert’ might be a more effective choice than a teenage comic superhero figure. Naturally, in this context the question of stereotypes, how they are utilized and how ‘traditional’ role models and expectations are dealt with needs to be carefully reflected.

## CONCLUSION

We presented the methods used in PEACOX to personalize and adapt a persuasive system towards more individual and effective trip suggestions. First experiences from the development and feedback from users indicate that the developed methods indeed can help to increase the uptake of persuasive suggestions and furthermore have a positive effect on the user experience (compared to not personalized interventions).

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## SPECIFIC TOPICS OF INTEREST FOR THE WORKSHOP

Authors would be specifically interested in sharing experiences and discuss opportunities and open issues with regard to the following research topics:

- How can advanced machine learning be best used to improve the efficiency of persuasive systems?
- How can persuadability and susceptibility to different persuasive strategies be best measured?
- How can different persuasive strategies be optimized?
- What are the effects of different presentation forms on the effectiveness of interventions?
- How can we best identify the optimal mix of target behavior, user type and persuasive approach?

## AUTHORS

**Johann Schrammel** is a social scientist and senior researcher at CURE. He is active in the field of HCI since more than ten years and is the author of a variety of publications in different fields. Johann has successfully led numerous national and international research projects, several of them focusing on aspects especially relevant for the questions discussed in the paper such as interacting with intelligent systems, information visualization, persuasion and user experience. He has also substantial experience in industrial projects. Johann is also professionally trained in group dynamics and has worked as group moderator.

**Sebastian Prost** studied media computer science at Vienna University of Technology with a focus on HCI and interaction design. At CURE Sebastian has multiple years of experience with user experience research and user-centered design. His work focuses on sustainability and

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