

Peacox – Persuasive Advisor for CO₂-Reducing Cross-modal Trip Planning

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Abstract. We present the objectives and first results of the Peacox project. Peacox aims at providing travelers with personalized multi-modal navigation tools that allow, help and persuade them to travel and drive ecological friendlier. To support the users in making travel decisions without feeling restricted, Peacox considers their situational and individual range of acceptable travel choices and provides personalized and tailored navigation support.

1 Project Overview, Motivation and Objectives

PEACOX - *Persuasive Advisor for CO₂-reducing cross-modal trip planning* - is an international research project aiming to provide travelers with personalized multi-modal navigation tools that allow, help and persuade them to travel and drive ecological friendlier. Existing navigation tools typically focus either on one trip mode, do not offer personalization or do not stress the ecological aspect. As ecological issues in environments become more and more pressing, means to reduce the ecological impact of people are needed urgently. A substantial part of emissions is related to traffic and mobility, and as work and leisure life becomes more and more geographically distributed it has become even more important to support and guide users to behave pro-environmental with regard to their travelling behavior and decisions.

To answer this need the main approach of Peacox is to provide travelers with personalized mobile and web tools that allow, help and persuade them to plan their trip aiming at the environmentally friendliest travel modes. To support the users in making this decision without feeling restricted, Peacox will consider their situational and individual range of acceptable travel choices. Peacox researches possibilities for influencing travel and driving behavior of users with the use of targeted persuasive strategies, providing situated and personalized feedback and use of advanced travel information systems.

Within Peacox, we develop mobile and web applications that enable the users on the move and at home to easily plan and organize their trip (by foot, bike, public transport, motorcycle, car, and by use of car pooling).

To achieve maximum impact, Peacox provides situated and located suggestions and information to the users regarding travel choices and options. The calculation and

presentation of options considers the current location of the users, their actual travel situation, their individual preferences as well as their travel mode choice and trip history. Considering all the relevant context information, the system aims at presenting the user only attractive and relevant suggestions.

Peacox reduces the need for explicit inputs by the user and thereby aims at increasing the user experience, comfort and willingness to use. This expected effect is a main research goal for the field evaluations of the system. In contrast to existing trip planning and impact calculation services, Peacox automatically keeps track of the users prior travel decisions and tracks (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. The user therefore is not required to e.g. always specify which means of transportation she/he is using to receive proper recommendations.

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 and therefore can provide more accurate data than simplistic and static computation models. Besides CO₂, the model also considers additional emissions such as NO_x, SO₂ and PM₁₀.

Peacox further presents relevant information for multi-modal trip planning and environmental impact feedback using persuasive interfaces targeted at reinforcing desirable behavior. The systems interfaces are designed with special consideration of guiding the user to choose less polluting alternatives utilizing known psychological principles and strategies, e.g. by making the consequences of choices clearly visible during the decision process. Special care is given during the design to focus on emotionally positive aspects rather than restrictive approaches. The current design incorporates the following persuasive strategies: *Suggestion*, *Tunnelling*, *Conditioning*, *Self-Monitoring* [4], as well as *Social Proof*, *Consistency and Authority* [3].

2 System Design

Figure 1 below depicts the core components of the Peacox-System and their interplay. The image shows a distinction between the frontend system (on the top left side of the visualization) and the backend system. In the frontend the user specifies his/her destination (Peacox provides already destination suggestions based on trip history) and the system then calculates and displays recommendations of different travel mode alternatives.

These recommendations are based on a process in the backend system. With the aid of GPS dynamically updated location data is collected from the user. After identifying trip segments and points of interest (POIs), Peacox classifies this data and subsequently creates a trip history for each individual user. With this information about previous travel behavior Peacox identifies travel patterns e.g. one user always uses public transport on the way to work. Those travel patterns include information about traffic mode, time and duration, preferences and location. Peacox uses this data to personalize the recommendations for travel behavior to the individual users, so users

are only presented recommendations that are within reasonable limits for the given user.

For each trip Peacox models the individual ecological footprint and calculates trip alternatives and their related ecological costs. This information allows to evaluate the environmental impact of different trip alternatives, which is then used in the user interface to influence the decision of the users by the mentioned persuasive strategies. Furthermore, information about actual impact of a user travels and possible savings is collected to be used for retrospective analysis.

Trip History, Travel Pattern Identification, modeling the environmental footprint and calculating trip alternatives get information values from GPS, weather, real-time traffic and statistical data. To increase accuracy and privacy the user has the possibility (but is not required) to verify the outcome of the detection process and to specify preferences and privacy settings which helps to increase the helpfulness of the system.

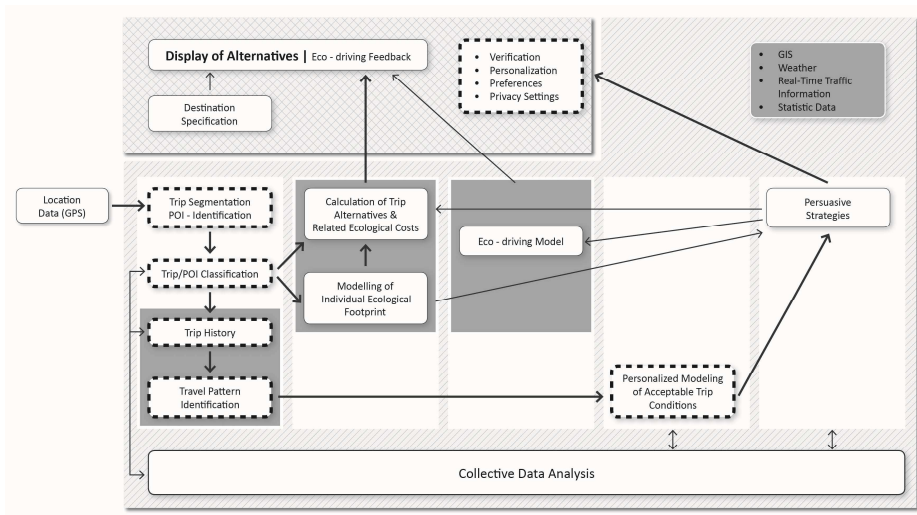


Fig. 1. Peacox System Concept

3 Personalized and Situated Persuasion

As outlined above one key concept of Peacox is to use personalized and situated persuasive strategies. Our main approach to the development of a system in accordance with this goal is to carefully balance and orchestrate the properties of persuasive strategies with the needs arising from contextual/situational variables and the characteristics of different user groups and personality types.

In order to do so on an implementation level we analyzed and classified persuasive strategies with regard to their suitability for different application scenarios, developed a classification and prioritization of context variables influencing mobility decisions and identified and analyzed user groups from two different perspectives: First, we had a close look on different trip choice models and typologies [e.g. 1, 5] and second we

studied the influence of the travelers environmental attitudes (measured by use of standardized inventories such as e.g. [8]) on trip mode choice.

To create personalized persuasive technology (which is expected to have greater impact than not-personalized technology), and to tailor the persuasive approach to the individual user it is also necessary to be able to estimate the susceptibility of a person to different persuasive strategies (persuadability) - this is also referred to as "Persuasion Profiling" [6]. We use available inventories [7] and also developed and validated our own methods [2] that can be used to estimate susceptibility to persuasive strategies to personalize persuasive technology according to the users' personality based on self-reports. In future work we aim at deducing persuadability characteristics by analyzing the users' behavior and reaction following persuasive interventions, thereby removing the need for explicit input from the user.

A second 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. 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. Both, trip mode and trip purpose are used to tailor the persuasion to the current situation and users need.

We currently are working on developing an overall model that integrates the different aspects influencing the persuasive approach and content. Integration is done both, based on theoretical considerations as well as based on empirical data collected by different means (questionnaires, experiments and field studies). Furthermore, design concepts on how the different elements can be best integrated with basic navigation functionality have been developed and are currently evaluated with end users.

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