MatkaHupi: a Persuasive Mobile Application for Sustainable Mobility

Antti Jylhä, Petteri Nurmi, Miika Sirén, Samuli Hemminki, and Giulio Jacucci
Helsinki Institute for Information Technology HIIT
Dept. of Computer Science, University of Helsinki
P.O. Box 68
FI-00014 University of Helsinki, Finland
Firstname.Lastname@helsinki.fi

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Abstract
With the advances in smartphone technologies, sustainable mobility has become an active research topic in the field of ubiquitous computing. We present a persuasive mobile application that automatically tracks the transportation modes and CO_2 emissions of the trips of the user and utilizes this information to present a set of actionable mobility challenges to the user. A longitudinal pilot experiment with the system showed that subjects perceived the concept of challenges as positive, with constructive findings to inform further development of the application especially related to personalized challenges.

Author Keywords
Sustainability; intelligent transport systems; behavior change; gamification; mobile applications

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

Introduction
Sustainable mobility has become an active research topic in the field of ubiquitous computing [8]. Applications such as UbiGreen [1,2] and PEIR [6] aim at motivating more eco-friendly traveling by means of tracking the effects of existing mobility behavior and

providing feedback to the user. This is also at the focus of the SUPERHUB project [7], which aims at developing an integrated fully multi-modal journey planner augmented with several additional functionalities, including techniques to motivate sustainable traveling.

Related to the SUPERHUB project, we have developed a testbed mobile application called MatkaHupi [5], which is capable of automatically tracking the CO_2 emissions of the journeys of the user and provides actionable feedback on more sustainable traveling options. MatkaHupi targets behavior change through personalized challenges that are tailored according to individual behavior and constructed through automated sensing of user behavior. Previous work has shown the need to adjust the feedback according to individual dispositions [4] and user behavior [3], however, this aspect has not been considered as part of previous applications for sustainable mobility. In this paper, we describe the current functionalities of the application and the results of a pilot study focusing on assessing the incorporated motivational elements and possibilities of extending the functionalities towards personalized challenges.

The MatkaHupi Application

The MatkaHupi application [5] has been developed for Android devices and provides the user with the following core components:

1. A journey planner for public transportation in Helsinki, making use of the open API provided by HSL (Helsinki Region Transport).

2. Automatic detection of trips taken and transport modes applied by the user, utilizing sensor fusion including positioning technologies and the accelerometer in combination with openly available public transportation route and schedule database.

3. Trip history, with which the users can review past journeys.

4. Visual feedback on the CO_2 emissions of the user during the current week and the past three weeks.

5. A set of challenges designed to motivate the user to make sustainable traveling choices.

The main screen of the application is depicted in Figure 1. The top of the screen displays the weekly CO_2 emissions and in the middle the user can review the emissions by transport mode. The bottom part shows the active challenges the user is trying to accomplish.

There are several types of challenges the application proposes to the user. After each detected trip, the application checks if the same trip could have been made faster and/or with less emissions (*trip challenge*). If this is the case, the application proposes as a challenge making the trip with the alternative route plan in the future. In addition, the system contains challenges such as walk or cycle for 3 km, which will after completion change to 7 km etc., and challenges such as try out the tram or metro. There is also a *weekly emission reduction challenge*, which is completed if the user reduces her weekly emissions by 10 %. After each completed challenge the user is awarded a badge and a certain amount of points depending on the challenge.

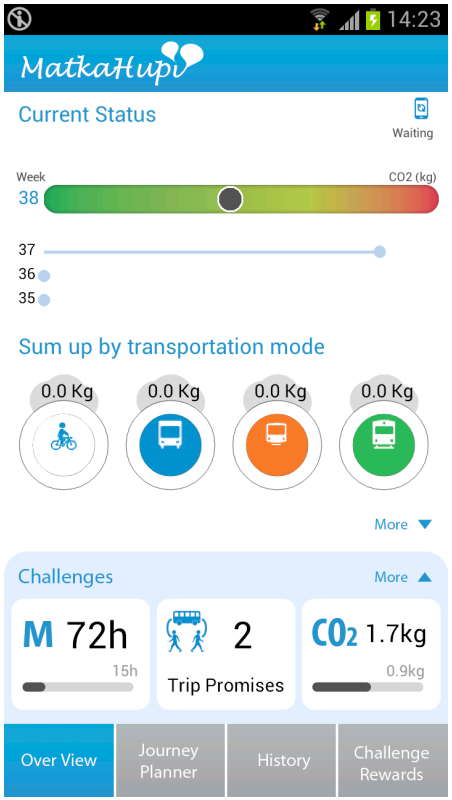

Figure 1. The main screen of MatkaHupi.

Pilot Study

In a pilot study we investigated the functionalities and effect of the application, with special focus on how the challenges were met by users of the application. 12 subjects used the MatkaHupi application for the duration of 4 weeks. 7 subjects (6 female, 1 male) used the full version of MatkaHupi, while 5 subjects (4 female, 1 male) used MatkaHupi without the challenges. The subjects were handed a Samsung Galaxy S3 phone with the application and mobile data plan pre-installed. The subjects filled in a set of questionnaires before, during, and after the experiment and were interviewed in the end of the study.

Results

In total, participants were presented with 149 challenges. Of these challenges, 44 were challenges that were automatically initialized, but not followed on. The challenges that participants accepted were generally completed as 95 out of the 105 accepted challenges were completed. The number of completed challenges varied between 9 and 19 (MD = 14, IQR = 6.75) , and the completion ratio between 78% and 98% (MEAN = 88%, STD = 6.4%).

The idea of challenges was favorably met by the subjects, although reactions to individual challenges were mixed. The functionality was commented to be useful, especially for people who are into sports or competitive. Challenges were reported to affect consciousness of the consequences of own actions. Subjects pointed out that not all the challenges suit all kinds of people, which calls for personalization of the challenges. For example, some subjects noted that while the walking challenges were good, the hardest challenge (10 km) was too easy. Trip challenges were only undertaken by 3 subjects and cycling challenges by none due to weather conditions in the winter.

Approximately half of the subjects considered the emission information on the main screen as interesting and useful, while for others it was mainly nice-to-know information. Three subjects reported that seeing the emissions drastically increase after car driving was

shocking or made them feel guilty. Several subjects noted that the emission estimates made them more conscious on the matter. Three subjects reported that seeing the emission estimates got them to make an effort in reducing the emissions; two of these subjects were from the group without the challenges.

Some stability issues with the application prototype were reported to affect the overall effectiveness of the challenges. Also the application consumed a lot of battery, which was considered a downside.

Conclusions and Future Work

We presented a mobile application aiming at motivating the user to select more sustainable means of transport based on a set of actionable mobility challenges. In a pilot study we found that these challenges were, in general, perceived positively and got useful results for personalizing the challenges. We are now revisiting the system design to include automatic tailoring of the challenges based on automatically tracking the mobility and the effectiveness of different challenge types for each user. The pilot study also indicated that for the larger-scale study we need to work on the stability and power consumption of the application. We are also considering extending the application with social features [5], which has been identified as a versatile strategy for motivating change [8].

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References

[1] Froehlich, J., Findlater, L., and Landay, J. The design of eco-feedback technology. In *Proc. CHI'10*, ACM (2010), 1999-2008.

[2] Froehlich, J., Consolvo, S., et al. UbiGreen: Investigating a mobile tool for tracking and supporting green transportation habits. *Proc. CHI '09*, ACM (2009), 1042-1052.

[3] Gamberini, L., Spagnolli, A., Corradi, N., Jacucci, G., Tusa, G., Mikkola, T., Zamboni, L., and Hoggan, E. Tailoring feedback to users' actions in a persuasive game for household electricity conservation. *Proc. Persuasive Technology '12*. Springer-Verlag (2012), 100-111,

[4] He, H. A., Greenberg, S., and Huang, E. M. One size does not fit all: applying the transtheoretical model to energy feedback technology design. *Proc CHI '10.* ACM(2010), 927-936.

[5] Jylhä, A., Sirén, M., Hemminki, S., and Jacucci, G. Augmenting a Persuasive Sustainable Mobility Application with Social Elements. *In CHI ´13 Workshop on Designing Social Media for Change*, ACM (2013), 4 pages.

[6] Mun, M., Reddy, S., et al. PEIR, the personal environmental impact report, as a platform for participatory sensing systems research. In *Proc. MobiSys '09.* ACM (2009), 55-68.

[7] SUPERHUB Project, http://www.superhub-project.eu

[8] Zapico, J.L., Turpeinen, M, and Brandt, N. Climate persuasive services: changing behavior towards low-carbon lifestyles. In *Proc. Persuasive '09*. ACM (2009), 14 pages.