
Co-Designing Motivational Features for Sustainable Urban Mobility

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Abstract

This paper describes the User-Centred Design process followed within the SUPERHUB project in order to investigate requirements, elicit user feedback and iteratively refine motivational features of a mobile app fostering the adoption of sustainable behaviors for urban mobility. We report the main lessons learnt from focus groups, participatory design sessions, low-mid fidelity prototyping and formative evaluation of the motivational features designed. These lessons are currently informing our implementation work in SUPERHUB and could be of interest for designers in the eco-sustainability field.

Author Keywords

Behaviour Change; Persuasive Technology;
Sustainability; Self-coaching interfaces;

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g.,
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General Terms

Design; Experimentation.

Introduction

Traffic in cities is responsible for about 40% of CO₂ emissions from road transport and 70% of other

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pollutants [1]. Making urban transport greener, more user-friendly and better organized is an important objective of the European Union in order to meet climate protection and energy saving goals, as well as to improve public health. In the SUPERHUB project [10] we are developing motivational technology aimed to support the adoption of more sustainable mobility choices and behaviors by citizens of large urban areas. This paper reports the main lessons learnt from the first year design and user research activities conducted to understand which digital intervention strategies could be effective to deploy in the project's European target cities of Milan, Barcelona and Helsinki. We first introduce related work on persuasive strategies for behavior change in the related domain of sustainability, then we describe the user-centred design approach followed to investigate, prototype and get citizens' feedback on initial strategies for motivating change deployed in SUPERHUB. We conclude by deriving the main lessons learnt from this work that can inform future design in the sustainability field.

Related Work

In the field of persuasive technology many applications have been developed to help people acquire and then maintain desirable behaviors and life-styles, particularly in the area of pro-environmental behaviors and healthy living. In this brief review, we focus on five main types of persuasive strategies for behavior change that have been investigated more extensively [3, 8]: goal-setting, rewards, games, self-monitoring, and sharing. Goal-setting has been used to stimulate energy saving, finding that households that received a difficult goal and feedback about their performance conserved the most with respect to a control group [12]. Goals have been shown to be most effective when they are

important to the individual (e.g., self-set rather than assigned), when they are realistic, when it is possible to monitor progress, and when positive feedback for progress towards goals is provided [5].

Rewards have been shown to be effective even if they are nominal (they reinforce a desirable behavior), but they should be closely linked to the target behavior [11]. They should be assigned when a person achieves specific goal milestones, which is why they are considered a core element of gaming technology, where points, levels etc. are assigned in order to motivate further players' engagement and provide incentives to their acquisition of the target behaviors.

Self-monitoring refers to a particular feature of some applications where user data are recorded for subsequent review and self reflection on one's past behavior. Often associated to reminders and feedback modalities to improve or change a specific behavior, self-monitoring can become an effective motivational strategy [6]. In the sustainability field the most effective feedback interfaces contained multiple feedback options (e.g., consumption over various time periods, comparisons, additional information like energy saving tips), were updated frequently, were interactive (e.g., the user could "drill-down" into data), and/or were capable of providing detailed, appliance specific breakdown of energy usage [2]. More work is needed to determine if these results translate also to other forms of pro-environmental behavior, like urban mobility; however, these findings show the potential of eco-feedback technology.

Sharing of data, within the same application or through Social Media, can also provide accountability and pressure to engage in pro environmental behavior [4] using competitions, social comparisons, and public commitments. While previous work has argued for the

potential benefits of sharing data through social networks, it has also identified several obstacles and challenges. People are often concerned about sharing personal and sensitive data with other people, they do not want to bore their friends with mundane posts or to share with others their modest achievements [7, 9]. There are also mixed predictions for the effectiveness of sharing goals, so more research is needed in order to understand how to best deploy this motivational strategy.

Co-Designing the Motivational Features

We adopted a participatory design approach for the development of an initial set of motivational features for the SUPERHUB project, starting from the review of digital intervention strategies reported above.

Focus Groups

Five focus groups were organized in the three target cities for understanding citizens' expectations and attitudes towards behavior change technology for urban sustainability. Participants (5 to 8 for each session) were balanced in terms of gender and represented different categories of project stakeholders (e.g., commuters, non commuters, drivers, non-drivers, etc.). Results showed that drivers (non-commuters) in Barcelona had some willingness to change for the sake of the environment, but admitted being far more influenced by other issues such as journey time. Participants in Milan suggested several forms of feedback on performance, including emissions, cost, calorie consumption, fitness. However, they also suggested that collective data (shared with others withing SUPERHUB or Social Networks) would motivate people more than individual feedback. Regarding the possibility of deploying serious games in order to

support sustainable mobility choices, participants in Milan suggested that a game should be local and realistic, should allow the user to do something during travel time (not only when at home). The game should also provide relevant feedback and rewards (like public transport discounts), educate and inform users about transport systems in the city, support users with simulations, include competitive elements and show how the user's behavior impacts their environmental footprint. To ensure players' engagement it should also link actions in the real world with effects in the game environment, be aligned with real-time information about traffic and transport, present specific game scenarios for tourists (e.g., treasure hunts games related to tourist guides) and be fun.

Participatory Design Workshops

Two Participatory Design (PD) workshops were held in Milan to further inspire the design of the motivational features of SUPERHUB. They involved four and eleven participants respectively, belonging to different user categories relevant to the project. Simple mockups of the five types of motivational strategies identified were developed (by using *Justinmind Prototyper* free version 1.1.1, <http://www.justinmind.com>) and presented to participants as screenshots of a prospective mobile application, in order to elicit their feedback on functional aspects of the interaction. Outcomes of the workshops showed that participants' had difficulty in clearly understanding the difference between the setting of eco-mobility goals and the setting of preferences regarding how to travel in the city (a way of personalizing the recommendations provided by the system). Some participants asked for a mobile app able to match different goals to different time periods (e.g., days of the week, evenings, etc). Also, in terms of the



Fig.1: Mockup of the Home screen



Fig.2: Mockup of the Improve screen

type of goals to be reviewed participants showed interest for the possibility of knowing the quantity of calories burned over their trips. Similar to the participants in the focus groups, PD participants highlighted the importance for the SUPERHUB system to provide rewards to users that exhibit desirable mobility behaviours (e.g., a free toll option for travelling in an area of the city where traffic restrictions have been introduced). Another important feature for them was the possibility of sharing with other users relevant information about mobility and updates on the traffic situation. Some participants said they would appreciate the possibility of reviewing, once at home, historical data about their previous trips and related eco information by connecting to the SUPERHUB website or platform. They put particular emphasis on the possibility of reviewing data about costs of journeys instead of other types of eco-related data. Regarding sharing strategies, participants showed a preference for the option to share their itineraries with other users, give feedback on travel options or suggest them to other users. Anonymity was desirable to the participants as was the ability to view other authors reliability / history in a similar way to eBay user profiles or Waze profiles. Regarding serious games, participants suggested to develop specific educational games for schools and expressed preference for games that do not need to be downloaded and installed in the mobile phone, but can be accessed from the SUPERHUB web site or platform.

Low-Mid Fidelity Prototyping

Based on the suggestions collected, we developed a revised version of the persuasive interaction mockups initially designed.

From the 'Start' screen (Fig. 1) the user can make a journey plan request, review her past trips, set ecogoals and travel preferences. S/he can also see what is the total ecoscore achieved and click on the three tabs at the bottom of the screen to directly access the 'Improve', 'Share' and 'Learn' features of SUPERHUB. There is also the possibility of checking rewards available with the total score achieved (e.g., special discounts on public transport tickets, free tickets for touristic events, etc.) as this was strongly suggested by our participants. In the 'Improve' screen (Fig. 2) the user can set very simple, mobility relevant goals to achieve in a particular timeframe (e.g., week or month). The goals relate to choices regarding the mode of transport used to reach their destinations during the timeframe. By moving the onscreen sliders users can see how by increasing the quantity of journeys made with sustainable modes of transport it is possible to get more points (e.g., when choosing sustainable means) or lose points (e.g., when using private car). The 'Improve' feature also allows users to review their real past trips, by comparing simple graphical representations showing how much they used the different modes of transport over a timeframe, and how closely they matched the eco-goals previously set. The system also allows the option of viewing details on each single trip made previously. In this way, users are given the opportunity of monitoring their travel behavior and choices, in order to foster self reflection and possible improvement of mobility habits over time.

The 'Share' screen (Fig. 3) provides the user access to a city map where s/he can localize sustainable mobility offers and services, share/compare scores with friends, post mobility relevant messages (e.g., events, trip plans etc.) and see posts made by other users. This



Fig.3: Mockup of the Share screen



Fig.4: Mockup of the Learn screen

SUPERHUB feature intends to support the creation of a SUPERHUB community where social influence factors (e.g., social pressure) can facilitate user adoption and maintenance of desirable behaviours as well as spread the use of the system in the city over time. In the 'Learn' screen (Fig. 4) the user can access the SUPERHUB Eco-Dealers game to potentially get more points and rewards. The user will also be provided with links to any relevant sustainable mobility resources or initiatives in their city to understand the consequences of travel choice. The main objective of this feature is to offer an opportunity of learning more on the topic of sustainability by using engaging and playful interaction means such as serious games.

Formative Evaluation

The motivational mock-ups were subsequently assigned to three usability experts (not involved in the design phase) in order to collect their individual Heuristic Evaluation reports. Experts provided several comments and suggestions for improvements of the functionalities designed. They also had a final meeting with the designers' team in order to clarify critical issues of the interaction and agree on a priority list for the changes to be made.

Two mid fidelity prototypes (for Android phones) of the functionalities designed were also developed by the design teams in Finland and Italy and are currently being tested through longitudinal (4 weeks), contextual user studies that due to lack of space will not be discussed further in this paper.

Main Lessons Learnt

In this section we summarize the main lessons learnt during this first design phase of motivational features for the SUPERHUB project. From the focus groups

results we realized that some citizens might not be very interested or prepared to change their behavior just for the sake of the environment. In order to change their mobility habits it would be worth focusing on providing them with recommendations that can more closely match their mobility needs or factors that are most important in affecting their transport choices (e.g., journey time, costs). We also found evidence that individual feedback/data on environmental footprint might not be motivating enough in order to trigger a user behavior change, since collective, real-time data about pollution at city level could be perceived as more meaningful and convincing by some individuals. The PD sessions helped to identify other personal triggers for behavior change in mobility choices, such as the possibility of tracking the benefits of choosing an ecological mode of transport (e.g. walking, bike) also in terms of fitness and personal health. This suggests the opportunity of developing motivational strategies for the sustainability field that leverage on healthy living interventions in a broader sense. As pointed out by previous research, designing effective rewarding and sharing features represents a major challenge. So far we found general support from our participants for the implementation of a rewarding system which is not just 'nominal' but brings concrete benefits in the real-life usage of urban mobility offers (e.g., discounts on public transport tickets, feasible to provide by SUPERHUB thanks to the presence of transport operators in the project). This was considered important also for engaging users in the Eco-Dealers game, at least initially when extrinsic motivation may play a stronger role in supporting viral mechanisms of dissemination and fostering participation. Regarding the sharing features proposed, the main feedback from participants was that they would be willing to share with other

citizens relevant real-time information about traffic, disruptive events and their transport choices, to improve mobility and sustainability. However, (as expected) concerns were also raised on the safety of the data exchange with a request for making notifications anonymous or restricting data sharing within a user's network of family and close friends.

Conclusion and Next Steps

In this paper we report insights from user research conducted during the first year of the SUPERHUB project in order to understand user requirements and preferences for motivational features of a mobile app fostering adoption of sustainable urban mobility behavior. We are now in the process of implementing a subset of the features presented (goal-setting, self-monitoring and the Eco-Dealers game) together with a Journey Planner and other mobility support functionalities that will be integrated in a first prototype to be tested with users in the three trial cities in 2013. The participatory design approach deployed so far will be carried on also in the next two years in order to iteratively refine and improve the effectiveness of the motivational components developed, as well as to advance the state of the art in the design of persuasive interventions for sustainable mobility.

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