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I-Pet Individual Persuasive Eco-travel Technology: A tool for VTBC program implementation

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Abstract

Voluntary Travel Behaviour Change programs aim to improve both community information and awareness about personal contributions to the negative effects produced by private car use. Indeed, providing individuals with feedback (travel time and costs, CO2 emitted, etc.), as well as information about existing alternatives to the car, has been shown to motivate people to reduce car use.
This paper presents the architecture of a technology platform constructed for the purpose of automating phases and activities of a Voluntary Travel Behaviour Change program, with a view to extending it to the large scale, reducing the resource commitment and enhancing the efficacy of the implementation.

Peer-review under responsibility of International Steering Committee for Transport Survey Conferences ISCTSC

Keywords: Voluntary Travel Behaviour Change programs; Persuasion; Persuasive Technology;

1. Introduction

Over the last decades the ever increasing use of the private car and the negative externalities resulting therefrom (congestion, local and global pollution, noise, safety and in general poor quality of life in urban areas) have led transport researchers to turn their attention to the issue of car use reduction.

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Several measures have been devised that aim to improve both community information and awareness about personal contributions to the negative effects produced by private car use, and about sustainable travel alternatives. They are known as Voluntary Travel Behavior Change - VTBC - programs (Ampt, 2003), and include information and persuasion techniques for influencing people to voluntarily reduce private car use (Bamberg et al., 2011).

So far, the implementation of VTBC programs has proven to be effective in reducing private car use (Brög et al., 2009) and analysis of the numerous projects conducted over the past 15 years has pinpointed the strengths and weaknesses of these measures.

In particular, the key factors identified for the effectiveness of a VTBC program are: target mobility context, target population, target behavior, personalization, information characteristics, communication and persuasion, the use of an integrated process model of travel behavior change.

- Target mobility context: identifying a certain local/transport promotion context, analyzing strengths and weaknesses of the transport system in general (level of service and capacity) and choosing the sustainable transport alternative to be promoted (Parker et al., 2007).
- Target population: segmenting individuals with respect to the alternative to be promoted. The new mobility style needs to be sustainable, advantageous and feasible for individuals involved in the program. This implies an in-depth knowledge of participants' socio-economic and attitudinal characteristics, of their activity-travel patterns and of any possible barriers to behavior change (Davies, 2012; Steg and Vlek, 2009; Sanjust et al., 2014b).
- Target behavior: selecting the most appropriate and feasible behavior change (Brög et al., 2002; Davies, 2012).
- Personalization: customizing the approach in a broad sense. Personalization is the most effective means of reducing or eliminating barriers to obtaining information and of promoting behavior change (Gärling and Fujii, 2009). The greater the level of information customization of a VTBC program (and the longer the data-collection period), the greater its effectiveness will be. In particular, when information and communications are addressed directly to a single user and provide personalized sustainable car alternative solutions, VTCB programs are known as Personalized Travel Plans (PTP). In practice, personalization affects:
  - the contact between the VTBC program team and the participants actively involved. Face to face communication is the most effective type of communication, since it allows a direct and personal contact and to interactively exchange information as opposed to one-way communication (Fujii and Taniguchi, 2006);
  - the mobility solution suggested. The personalized travel plan provided to participants needs to be customized on the basis of life style of each individual. This involves detailed and continuous (several days) activity-travel data collection for assessing the intra-variability of each individual (Stopher, 2005);
  - feedback provision. In general, individuals are not fully aware of the characteristics associated with the not-chosen alternatives (and even those chosen) and are unable to quantify the effects of their behavior, both at the personal (time, costs) and community level (extra-costs and CO2 emitted, for instance) (Shwanen and Lucas, 2011; Gaker and Walker, 2011). The feedback can be provided in the Personalized Travel Plan in relation to observed behavior (car use), highlighting the negative effects and to the proposed behavior (sustainable travel), highlighting the positive effects.
- Information characteristics: combining several types of information in order to influence directly the psychological factors that are determinants of behavior change. Information must be useful, usable and used: besides being accurate and reliable, it should also be visible, easy to understand and rapidly acquired. Brög (2000) and Fujii and Taniguchi (2006) also stress the importance of receiving the necessary information without expending too much effort and of avoiding overload (bounded rationality, bounded cognitive capacity; Simon, 1982). Further, information may be more effective if, for instance, it is repeated, as repetition reinforces the message (though, in some cases, may make it boring) (Fogg, 2003; Economic and Social Research Council, 2008).

- Communication and persuasion: applying specific communication and persuasion principles (Cialdini, 2001) in a VTBC program. Several studies have demonstrated that information provision alone may not be effective in inducing people to change their behavior (e.g. Abrahamse et al., 2005). Indeed, the provision of information is just one of the elements of the process that attempts to evoke behavior change, which comprises other elements such as communication and persuasion techniques which are founded on a thorough knowledge of human behavior (Seethaler and Rose, 2006).
- Use of an integrated process model of travel behavior change: the success of these measures can be explained if the various behavioral interventions are integrated in a process model of travel behavior change based on sound theories of behavior analysis (Ajzen, 1991; Schwartz, 1977; Stern, 2000; Triandis, 1979), theories of change (Carver and Scheier, 1998, Prochaska and DiClemente, 1982; Prochaska and Velicer, 1997; Gollwitzer, 1999) and theories and applications of social marketing (Defra, 2008) and persuasion principles (Cialdini, 2001).

These requirements enhance the effectiveness of the strategy. However, they imply a level of knowledge, analysis and commitment that can be costly and difficult to achieve. The main limitations are outlined below.

First, personalization affects the size of the recruitable sample. The more customized the travel behavior monitoring and the suggestions given are, the smaller the sample involved. Customization involves activity-travel data collection. This information is obtained using conventional methods (paper activity-travel diaries) (e.g. Rose and Ampt, 2001). The diaries are then analyzed and for each individual a personalized suggestion is prepared (with feedback). Of course, this procedure can be costly and if the campaign is conducted on a large scale it is difficult to maintain a high level of customization.

Second, personalization affects the manner (how, when, through what, etc.) in which information is provided. Currently, the most popular VTBC programs provide information through traditional dissemination channels (direct contact with a consultant, mailing letters, brochures, posters, etc.) or through purpose-built websites (Fujii and Taniguchi, 2006). Further, highly personalized VTBC programs provide information in a face to face meeting between team advisors and individuals, by phone or by mail.

Third, persuasion techniques, through direct and interactive communication, can be feasibly implemented in a face to face meeting between team advisors and participants. Thus, it is very difficult to define the necessary actions such as comparison with others, promptness in provision, receipt and requests for information, advice and messages, repetition, reinforcement and monitoring, and so on. In addition, face-to-face contact obviously involves higher costs than more generalized information, thus diminishing the effectiveness of the VTBC program.

In this context, technology can potentially contribute to facilitating the operational and functional aspects, through the implementation of automated VTBC programs, broadening their applicability while maintaining effectiveness. Basically, technology can offer five main advantages for improving the effectiveness of a VTBC program: (1) a high level of personalization in data/information collection (in this regard Meloni and Sanjust (2014) have demonstrated the efficient use of technology for data collection in the context of a VTBC program), (2) the provision of real-time and timely personalized information, (3) the ease with which information can be acquired and (4) automation of the whole procedure for large-scale implementation, (5) networking and comparison with other individuals.

Further, it has been demonstrated that technology itself can be persuasive in achieving a certain behavior (Fogg, 2003).

In particular, a new research field has emerged, known as Persuasive Technology that concerns the environment and interactive technological systems that can be designed for influencing attitudes and behaviors (Fogg, 2003; IJsselsteijn et al., 2006; Fogg, 2009).

The objective of the study is to develop a VTBC program that uses technology both for enhancing the efficacy of the implementation and for highlighting the contribution that technology itself can provide in persuasion strategies. In particular, this paper aims to identify a means of replacing the traditional information provision methods with a direct, automatic, instantaneous and dynamic system that is able to send clear and persuasive information and advice to mobile devices. This system is called IPET (acronym for Individual Persuasive Eco-travel Technology) and can be configured as a technology platform useful for implementing a large-scale VTBC program at an acceptable cost.

For information acquisition, analysis, processing and transmission, the platform will be required to manage a marketing campaign on sustainable mobility, providing a personalized program, similarly to a real mobility supervisor, constantly supporting people in their travel choices and encouraging them towards environmentally sustainable behavior, thereby reducing CO2 emissions and the negative impacts of car use.

The paper is organized as follows: Section 2 provides a literature review of Persuasive Technology (par. 2.1), and existing mobile persuasion applications (par. 2.2). Section 3 presents the structure of the IPET platform. Section 4 presents the results of a first small pilot test and our main conclusions.

Nomenclature

AL	Activity Locator
IPET	Individual Persuasive Eco-travel Technology
FBM	Fogg Behaviour Model
PTP	Personalized Travel Plan
VTBC	Voluntary Travel Behaviour Change

2. Literature Review

2.1. Persuasive Technology

Several studies have demonstrated that information provision alone may not be effective in inducing people to change their behavior (*e.g.* Abrahamse *et al.*, 2005). Indeed, the provision of information is just one of the elements of the process that attempts to evoke behavior change, which has to comprise other elements and communication and persuasion techniques (motivation, ease of interaction with which information is exchanged and/or conveyed, *etc.*) which are founded on a thorough knowledge of human behavior (Cialdini, 2001).

Persuasion has traditionally meant human communication for influencing autonomous decisions and actions without coercion or deception (Simons *et al.*, 2001). The science of persuasion, based on social psychology theories, together with communication theories and techniques, attempts to theorize about the behavior of recipients of messages, especially persuasive messages. The six principles of persuasion identified by Cialdini (1991) (*Reciprocation, Commitment and Consistency, Social proof, Liking, Authority, Scarcity*) are based on the findings of numerous researchers, who observed that before making a decision individuals do not always have the time required to obtain all the available information and to choose for themselves. Consequently they look for short cuts and use their common sense (heuristic rules) to accelerate and simplify their decision making process (for a review of these theories see Kahneman, 2011).

Further, persuasion implies a voluntary change of behavior or attitudes or both (IJsselsteijn *et al.*, 2006). In the context of information strategies persuasion is therefore an important tool for behavior change.

The new research area of Persuasive Technology that emerged recently (Fogg, 2003) is still being developed and improved through different frameworks and models. Persuasive technology focuses on how interactive technology and services can be designed to influence people's attitudes and support behavior change (Busch *et al.*, 2012) and in particular on how it is able to transform the user's current cognitive state into another planned state (Torning and Oinas–Kukkonen, 2009), also defined *target behavior* (Fogg, 2009). The interactive aspect is the real novelty of these new information technologies (computers, smartphones, tablets, mobile applications, *etc.*) compared to the traditional media such as radio and television. Indeed, as well as conveying a persuasive message they can also take into account user actions, until *gamification* mechanisms come into play (using the dynamics of the game to get people involved in certain activities, stimulating commitment and competitiveness, to influence and persuade them to perform certain behavior, through scores and badges that allow comparison with other users).

The Fogg Behavior Model - FBM (Fogg, 2009) might help to understand how persuasive technology needs to be designed for influencing people's behavior.

The FBM is very simple and identifies 3 behavior change elements, namely: motivation, ability, triggers.

These three elements must take place simultaneously for target behavior to occur. In particular, target behavior is more likely to occur if the individual has some non-zero level of both motivation and ability. However, without a trigger, the target behavior will not occur even if motivation and ability are high (over the behavior activation threshold). The trigger can have different forms (sound, text message, light *etc.*) and is something that tells individuals to perform the target behavior on time (well-timed trigger). In this context, persuasive technology may help to achieve the co-existence of these three elements. It could enhance motivation and ability (simplicity) in order to attain the activation threshold and then trigger the target behavior at the right moment. The just-in-time feature is a peculiarity of interactive technology, and thus of persuasive technology (IJsselsteijn *et al.*, 2006).

Persuasive technology, to be more effective in achieving the desired behavioral change, requires the use of persuasive elements, which Fogg (2003) sets in 7 points; the elements of persuasion to be applied are:

1. Tailoring: taking into account individual needs, interests, personality, and other relevant factors. Further, personalized feedback about observed behavior can trigger positive behavior (IJsselsteijn *et al.*, 2006).
2. Reduction: simplifying or facilitating the procedure users adopt to behave in the suggested way, so as to minimize any barriers that may impede or hinder behavior change.
3. Self-Monitoring: the possibility of each user monitoring their own behavior in order to change their own attitudes/behavior for achieving a pre-determined objective or outcome (*i.e.* the recommended behavior).
4. Tunneling: guiding users through a procedure or experience, increasing the likelihood of persuading them along the pathway.
5. Suggestion: providing users with hints and tips, as a reminder to behave in the suggested way, thereby increasing the persuasive power.
6. Surveillance: controlling and monitoring certain behavior can affect behavior itself. When people know they are being monitored they tend to behave differently.
7. Conditioning: to (positively) influence user behavior through incentives and/or prizes that reward users when they adopt a recommended behavior.

2.2. Mobile Persuasion

One key tool that has made it possible to further improve persuasive technology is the smartphone. Thanks to its ability to access the internet, people have on hand all the information they might need, anytime, anywhere. It is estimated that by 2015 approximately 80% of internet users will gain access via their mobile phone (Johnson *et al.*, 2011), enabling widespread access to information. This has led to the emergence of the so-called mobile persuasion (Fogg, 2007), the natural and direct evolution of persuasive technology, which operates exclusively in a "mobile" environment. Various applications for smartphone have appeared. They aim to persuade people to change certain behavior. These are mobile applications (“app”) that operate in different areas: health (diet, smoking), physical activity (exercise), television and internet use, stress management, promotion of eco-friendly behavior in general (*e.g.* energy consumption, water consumption, transportation, *etc.*).

Many of these applications also apply *gamification* mechanisms. Gamification consists in game-thinking and game mechanics to engage people and is adopted for influencing human motivation and behavior (Zichermann and Cunningham, 2011).

Some interesting applications for smartphones have been developed recently in the transportation area. These rely on advanced computational platforms for the collection, analysis and processing of data and information and are aimed at persuading people to modify their travel behavior in a sustainable way. Some examples are reported in the follow.

Ubigreen Transportation Display (Froehlich *et al.*, 2009) consists of a mobile application that heightens awareness about sustainable travel behavior through feedback. Small visual/graphic rewards are received by users every time they travel sustainably: on foot, by bike, bus, train or carpooling. The distinctive feature of this application is that, in response to the travel behavior automatically detected, the homescreen background of the smartphone is changed with the aim of promoting sustainable trips. Users also earn points (credits) for sustainable travel.

Quantified Traveler (QT) (Jariyasunant *et al.*, 2013) consists of a computational travel feedback system, in which feedback about the trips is used to change travelers' mode choice or trip choice. QT is able to passively collect user data (through GPS and other automated sensors), convert them into a travel diary, quantify feedback in terms of time and money spent on travel, calories burned and CO_2 emitted, and, finally, provide users with the results.

MatkaHupi (Jylhä *et al.*, 2013) is an application able to motivate people into choosing sustainable modes of transportation, relying on a set of challenges. After each detected trip, the system checks whether the same trip could have been made faster (less travel time) and/or with lower emissions (trip challenge) using a sustainable alternative. Therefore the application challenges the user to consider, in the future, the alternative trip proposed. If the user takes up the challenge, then he/she is rewarded with a badge and a certain number of points, depending on the type of challenge (gamification).

Peacox (Schrammel *et al.*, 2012) is an application that aims to provide users with customized tools for multi-modal navigation, which helps and persuades them to plan their trips in a more eco-friendly way. Peacox requires the user to indicate trip origin and destination shortly before beginning the journey. In this way, all the available alternatives are calculated together with the relative characteristics: mode, time and cost of travel, route, distance, departure and arrival times, *etc.* Another interesting feature is represented by the real-time feedback that, depending on the particular travel behavior monitored, changes the smartphone background.

SuperHub (Carreras *et al.*, 2012) is based on the big-data approach applied to mobility ecosystems. Exploiting advanced reasoning techniques and data analysis tools, SuperHub automatically collects different types of data (public transport and road traffic information, GPS data, weather/pollution *etc.*) and processes them in order to provide users with personalized and "green" journey plans.

Lastly, Tripzoom (Broll *et al.*, 2012) is another approach to mobile mobility that uses mobile devices and application to improve personal mobility. The objective is to motivate car users to change their travel behavior providing them with incentives that match their interests and preferences.

In short, exploiting the most recent developments in technology is the key to revolutionizing the whole VTBC program implementation procedure: from data collection, analysis and processing to deployment of personalized information and user/platform interaction management. Everything is managed via a smartphone application that provides an interface between users and the complex computational system that collects, analyzes and processes data. This makes it possible to automatically manage a large amount of data and information, thus permitting implementation of customized programs for changing travel behavior at the large-scale.

3. The IPET platform

IPET, acronym for Individual Persuasive Eco-Travel Technology, is a technology platform for implementing a large scale VTBC program for promoting sustainable alternatives of transport (Sanjust *et al.*, 2014a).

In particular, this platform makes it possible to collect and process activity-travel data and automatically deliver information. This platform has been designed following the requirements, principles, and design procedures found to be fundamental for influencing the behavior and for enhancing the persuasive features in promoting sustainable travel behaviors. IPET, in fact, by means of a free mobile application (called Activity Locator and described in more detail below), allows the monitoring and analysis of car users' behavior (*surveillance*), analyzes their actual behavior for identifying a prospective sustainable alternative solution (*tailoring*), provides a simple and well explained personalized travel plan (*reduction and tunneling*) accompanied by quantitative feedback based on the observed and suggested travel behavior (*tailoring* and *suggestion*). All information that is sent to the user is highly customized and based on the individual's particular needs and characteristics (*tailoring*). Further, the personalized travel plan simplifies the complex process of considering different alternatives of transport (*reduction*), providing the user with a tailored alternative that is both feasible and convenient. Moreover, following the provision of the personalized plan, the dispatch of reinforcing messages characterized by images and text is scheduled, the content of which depends on the particular travel behavior monitored (trigger, *monitoring and suggestion*). This guides users through a process (*tunneling*), represented by the monitoring period, in which they feel fully accompanied and supported by technology that, in response to their behavior, shows approval or disapproval (*conditioning*), guiding them towards the target behavior. Further, users can also monitor their own behavior (*self-monitoring*), via a dedicated webpage accessed using personal credentials, which allows them to view their movements and feedback quantities. Finally, in order to implement *gamification* strategies to incentivize car use reduction, the software automatically calculates the scores, based on observed travel behavior (km travelled by different modes), so that participants can compare their ranking which is displayed on his/her dedicated webpage.

3.1. The IPET Architecture

Technically, the IPET architecture is composed of 5 elements: (1) Mobile application (Activity Locator), (2) Server, (3) Analyzer, (4) Simulator, (5) Information delivery system (see Fig. 1).

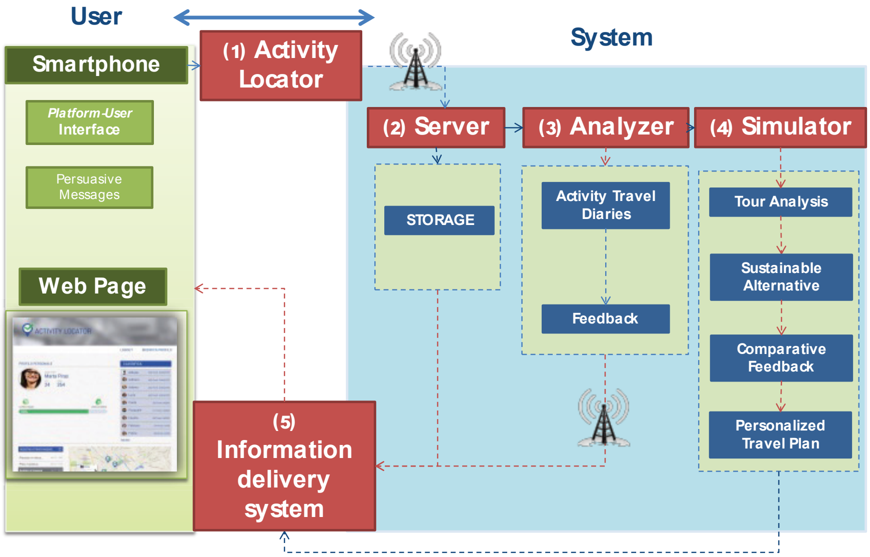

Fig.1– The IPET platform

The Activity Locator - AL (1) is a mobile application that can be installed in any smartphone (Symbian, Android and IOS platform) with built-in GPS currently available on the market.
The application tracks individual daily routes in real time and collects all activity-travel related information through a sequence of pull-down menus that reproduce the classical activity-travel diaries. The activities/trips recordable with Activity Locator include more than thirty disaggregated activity types among in- and out- of-home (*i.e.* personal care, household care, meals, sport, recreational activities *etc.*), company involved (*i.e.* alone, with family members only, with family and others *etc.*), and travel attributes (trip mode, vehicle occupancy and tickets paid). The main difference with traditional paper activity-travel diaries is that activities are recorded in real time, instead of at the end of the day at home. Compared to passive travel data detection the AL enables "active" interaction between individuals and the platform that makes it possible to continuously involve participants in the program. Indeed, although automatic spatial data collection is possible via GPS, the active mode used for recording activity and trips via the app heightens participant motivation and awareness of the important role they play in making the project a success.

Data recorded by the Activity Locator application are instantly sent to a Server (2) via an Internet connection, making them immediately available for download in the required format (*e.g.* .xls, .csv, *etc.*). The server collects the information sent by each participant and once stored, conveys all the data to the Analyzer (3) which analyzes activity-travel data and converts them into an activity-travel diary.

In this phase the analyzer automatically calculates all the attributes related to monitored activities and trips. In particular, it calculates the time spent in in- and out-of-home activities (for different purposes and company). Travel behavior is analyzed for different travel mode options; for each mode travel times, costs, distance travelled, CO_2 emitted (motorized modes) and calories burned (active modes) are calculated. These four elements represent the quantitative feedback regarding the observed behavior. Compared to the previous application (Meloni *et al.*, 2011; Meloni and Sanjust, 2014), each user can actually view his/her activity-travel diary at any time via the app (Fig. 2).

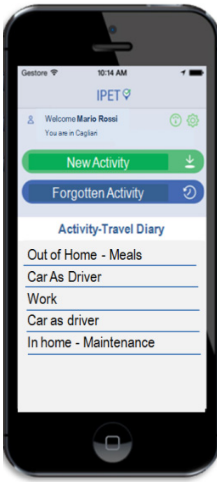

Fig. 2 – Activity-Travel Diary

The Simulator (4) receives the diaries accompanied by quantitative feedback and manages them in order to identify the alternative to be suggested. In particular, through a tour analysis the simulator identifies a tour or a set of tours travelled by car, and on the basis of spatial information (origin, destination, stops) identifies the available sustainable alternatives, along with a simulated feedback (travel time, waiting walking time, fare, calories burned). On the basis of the most convenient comparative feedback a personalized travel plan (PTP) is prepared for each user, accompanied by feedback (on a daily, weekly and yearly basis) on the observed and suggested behavior (see Fig. 2).

This information is sent to each individual (a) via mail and (b) to a personal webpage of the project website that each user can view after logging in (Information delivery).

From the webpage (b) (see Fig.3) users can (*i*) retrieve information about their observed travel behavior on a map and in their daily diary, (*ii*) check the PTP and feedback information (disaggregated on each single journey made or in daily aggregate terms) and (*iii*) check their score. The scoring system is based on a comparison of the observed behavior before and after delivery of the PTP, rewarding sustainable behavior (public transport, walk, bike) and penalizing private car use. In particular, the Simulator calculates, for each individual, the daily average distance travelled by car before the PTP provision. This value is used as a baseline for comparison with the distance traveled by car after PTP provision. Positive scores are assigned when the distance decreases, negative otherwise. The scoring system also provides positive scores when sustainable modes are used, with a preference for non-motorized options. By so doing, each user is able to compare his/her behavior with the others within a ranking (gamification mechanisms); a badge is also assigned on the basis of the level attained (Fig. 4).

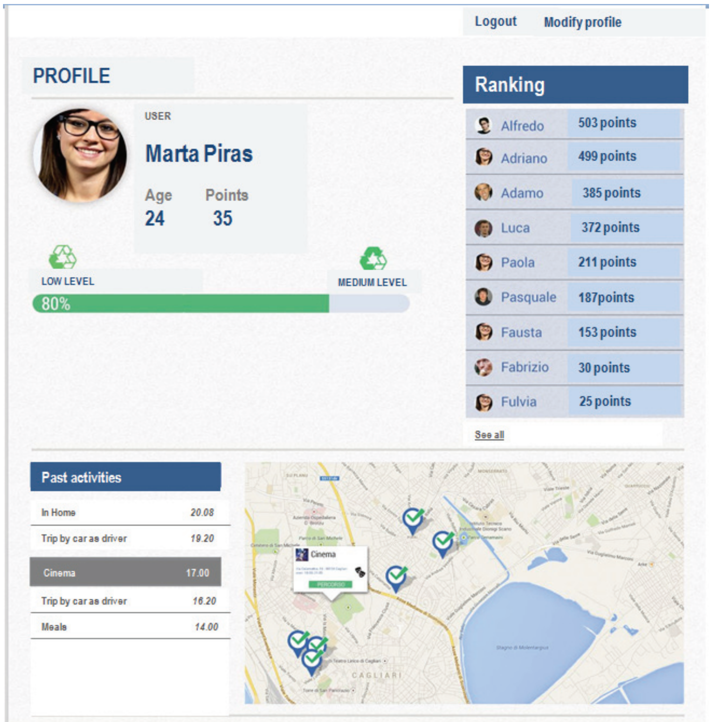

Fig. 3 – Personal webpage

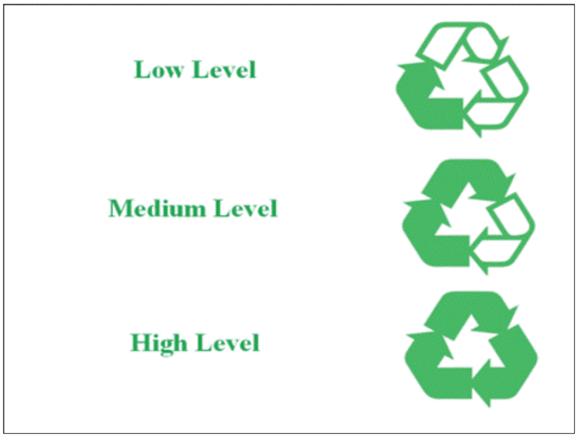

Fig. 4 – Badges in the game

Information is also conveyed using (c) brief persuasive messages that combine text and images in different forms. In particular, after PTP provision, depending on the users' observed travel behavior, the Information delivery system sends messages that can express either approval or disapproval. If users prove to have successfully followed the sustainable advice, then they will be congratulated; conversely, if they continue to use the car for their trips, the message will express disapproval (examples are reported in Fig. 5). The aim is to reinforce the message conveyed by the PTP, making users feel proud if they reduce car trips (and, therefore, if they use public transport, along with cycling and/or walking), or guilty, if they prove to be addicted to their car.

In addition, after the first phase of acquiring information about actual travel behavior, in order to increase both participants awareness about the importance of using sustainable modes of transport and the motivation to reduce the distance traveled by car, the platform can send some general information messages about the negative effects produced by car use in the city in which they live.

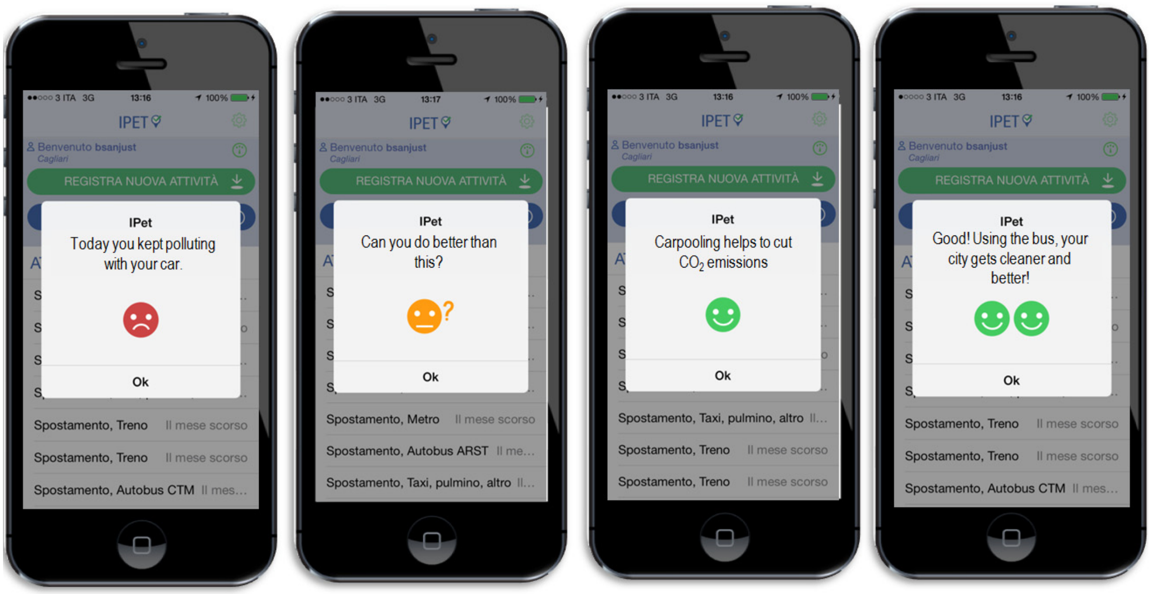

Fig. 5 – Persuasive messages

The combination of PTP and messages for persuading people to reduce their car use plays a very important role. Indeed, the design and presentation of information need to be carefully thought out so as to pursue the goal as effectively as possible. The information and communications provided, along with the graphics, are fundamental for effective persuasion. As suggested by Gaker and Walker (2011), presenting information is a delicate aspect that can have repercussions on participants' propensity to accept the proposed suggestions. Notions need to be accurately and clearly presented in a way that can attract participants. Thus, the personalized travel plan, the feedback and the messages must contain information that is easy to understand, reliable and acceptable. Persuasive graphics are used for the representation.

4. Conclusions

In this paper we presented the architecture of a technology platform, constructed for the purpose of conducting personalized campaigns for promoting sustainable transportation. In particular, the proposed platform should be able to automate phases and activities of a VTBC program, with a view to extending it to the large scale, reducing resources commitment. The platform was designed following the basic principles of a VTBC implementation, together with what has emerged from best practices in persuasive technology.

At the present time, implementation of the VTBC program is at an advanced stage. Particularly, the context and population target have been defined (by means of transport analyses, focus groups with users of different transport modes, for the public bus service in the central area of the city of Cagliari (Italy)). Recruitment is under way through a sensitization campaign conducted in collaboration with the local transport agency, intercepting car drivers to complete a questionnaire. Out of the potential candidates (the survey is still in progress) 15 people have been involved in the first pilot test (3 days before and 3 days after PTP provision) for testing the platform.

In order to evaluate this pilot study in terms of commitment and acceptability of the technology platform, in a final questionnaire (compiled online), users were asked to give their impressions about different aspects of the experiment, and in particular problems related to IPET usage, form and content of PTP, sustainable alternative proposed, types of feedback provided, persuasive effects of reinforcing messages and their form and content, and web page. The aim was to gather useful feedback for improving the VTBC program as a whole and in particular the persuasion tools (PTP and messages).

The findings suggest that the commitment required for using the app was acceptable. The most frequent technical problems reported were rapid battery consumption of the device and occasional crashes which meant the application had to be restarted. The personalized information provided was clear, easy to understand and particularly appreciated (e.g. maps, form and colors of PTP). Regarding the feedback provided, users indicated travel time as the most important feedback, followed by travel costs, CO2 emitted and, lastly, calories burned. Participants also appreciated the reinforcing messages that proved easy to read on the smartphones, acceptable and clear. Various layouts were proposed; messages containing text and a cartoon image, and messages containing text and a realistic image. Out of these three types of reinforcing messages, pilot test participants preferred the first, namely text and cartoon images (see Fig. 5). Further, interesting suggestions emerged regarding PTP transmission, recommendations provided and timing of messages to be sent. These elements could prove useful for improving the presentation of the information (personalized travel plan) provided, and in general, for the implementation of a Voluntary Travel Behavior Change program conducted through a technology platform.

Future developments will concern continuation of the test phase on a larger sample, focusing on both single elements and the entire sequence of activities carried out by the platform.

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