Involving people in the building up of smart and sustainable cities: How to influence commuters' behaviors through a mobile app game

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ABSTRACT

Usually, mobility policies assessed by local institutions tend to intervene on the side of the urban transport networks, by designing new and expensive infrastructures, whereas only a few attention is paid to the possible positive effects induced by proper mobility behaviors of people. On purpose, Smartphone technologies and platforms are rapidly becoming effective tools for involving citizens in environmental conscious mobility habits. By means of an empirical application to a group of university students, that daily commute for reaching their departments, the effectiveness of a mobile app game in pursuing commuters to modify their mobility behaviors is here checked. The game rewards with tangible prizes the most environmentally sustainable mobility habits, connecting commuters with sponsors and companies operating in the urban context.

The field application of the app in the city of Palermo challenges the involved commuters against two benchmarks of mobility behaviors characterized by the use of higher sweet mobility means. The first scenario (apart its applicability as alone) can be seen as a first less challenging step towards the second one. The interesting outcomes of this experimental application encourage paying further attention to such behavioral tools for achieving the smartness of cities.

1. Introduction

Copying with traffic and congestion in urban areas, in a period characterized by scarce availability of economic resources, represents a relevant challenge for local government. On the other hand, this complex situation can be seen as a favorable opportunity for implementing innovative and low-cost mobility solutions. In other words, since the modification of the transport system is an expensive and time-spending process, it is widely recognized that the problem could be approached also by stimulating change in the citizens' behaviors towards mobility (Corriere, Rizzo, & Guerrieri, 2013; Corriere, Peri, Rizzo, & La Rocca, 2013; Guerrieri, Corriere, Rizzo, Lo Casto, & Scaccianoce, 2015; Madlener & Sunak, 2011).

Smartphone technologies and platforms, thanks to their rapid spreading among people, almost regardless cultural, economic and ethnic belongings, seem to easily becoming effective tools for involving citizens in this purpose. By means of an empirical application to a group of university students, that daily commute in order of reaching their

departments, the effectiveness of a mobile app game (TrafficO2) in modifying the mobility behavior of this sample of citizens is here checked. The game, rewarding the environmentally sustainable mobility habits, connects commuters with sponsors and companies operating in the urban context, in this way contributing to the growth of a network of virtuous categories of citizens.

This article provides the provisional results of an applied research carried in Palermo, the fifth largest Italian city and home of around 700,000 residents. Being the city still ranked as one of the most congested medium-sized cities in Europe (see: TomTom Traffic Index, 2016), a growing debate is taking place among citizens and policy makers around the ways to tackle the weaknesses in the transport and mobility systems. Alongside with the implementation of large infrastructure projects, different local stakeholders advocate for the relevance of the 'soft' factors for urban mobility (Vinci & Di Dio, 2016), including the initiatives to stimulate the civic engagement in the promotion of more responsible and sustainable transport behaviors.

This approach tends to cover a remarkable gap in order of making

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more sustainable the mobility of people in urban contexts. In fact, usually, mobility policies assessed by local governmental institutions tend to intervene on the side of the urban transport networks, by designing new and, generally, very expensive infrastructures, whereas only a few attention is paid to the possible positive effects on the performances of the traffic flows induced by new behaviors of people.

In this direction, the project described in the present paper is based on the analysis of the mobility behaviors of a group of university students in Palermo, which daily commute for reaching their campus-based departments. Such habits are tracked through a mobile app which also constitute a platform for a community game aimed at distributing rewards to those members able to shift their mobility behaviors in a more sustainable way. Accordingly, two different enhanced behavioral scenarios have been hypothesized where people is pushed toward more sustainable mobility habits by using emulative games.

TrafficO2 is a platform for value exchange: for every responsible choice, there is a tangible market value, and every choice will advertise and communicate Local Business Stations. Indeed, many reasons could encourage people to change their habits: "extrinsic reasons", such as rewards and challenges, and "intrinsic reasons" (Pierce, Cameron, Banko, & So, 2003) such as the information on the burnt calories, the cost, the carbon footprint, etc. In other words, TrafficO$_2$, by combining information on mobility, advertising and the game, tries to provide commercial motivations and emotional input to push people to change their mobility habits. It is a "not for profit business model" and its final aim is to guaranteeing a completely free service for the citizens and covering the administration costs by applying a business fee for the partners in exchange for the advertising content campaign and the specific market analysis that it develops.

TrafficO2 is here utilized for checking the inclination of a given category of commuters in choosing low-carbon mobility modes under the pushing action of a game based on rewards for sustainable mobility preferences: in this way, the present research tries to provide a contribution in covering the existing gap concerning the direct involvement of citizens in the building-up process of smart cities.

With this context in the backdrop, the project has been developed according to the following general assumptions:

- First, in the increasing mobile societies where we live (Grieco & Urry, 2012; Urry, 2007), (social) networks may perform a central role in sharing information among individuals and groups and, in turn, fostering more responsible behaviors towards the environment;
- The second assumption is that ICT solutions can play a fundamental role in treating a large amount of data and that mobile apps, being largely used, make more easy the construction of evolutionary scenarios to make available for public policy;
- The last assumption is that incentives – in this case a rewards system provided by a social game –, by conditioning the individual behaviors even more then restrictions and penalties (Poslad, Ma, Wang, & Mei, 2015), can play a significant role in subsidize the traditional approaches to regulate mobility in the urban areas.

Being the article an account of a project that lies in the field of action research (Lucas, 2013; Reason & Bradbury, 2007), the outcomes outlined below have been developed through a mix of quantitative and qualitative methods.

2. Theoretical framework

In modern times, the improving of the performances of the urban mobility can be properly achieved by directly involving citizens and their habits. This approach is part of the new smart cities vision, in which the promotion of transportation means, which are alternative to the private ones, is a crucial point (Garau, Masala, & Pinna, 2016) for creating sustainable urban contexts (Fenton, 2017). This is well

recognized by the Sustainable Development Goal 11 that, starting from the consideration that half of humanity lives in cities (with a still ongoing urbanization trend), aims to render urban contexts more inclusive and, in the same time, safe, resilient and sustainable.

Designers suggest the necessity of a change of the citizens' mentality towards new mobility systems (Gaker, Vautin, Vij, & Walker, 2011) and claim that this change of mentality is made quicker and more productive by the new information technologies. Some USA for profit projects, such as Nuride (http://nuride.com/), Zimride (http://www.zimride.com/), Lyft (https://www.lyft.com/) and the equivalent European ones, such as Moovel (https://www.moovel.com/en/US/), Mo-bility (http://www.mo-bility.com/mo/home_html), Covivo (http://www.covoiturage-dynamique.eu/), are orienting the cities changing opportunities from the urban street network (the "hardware") to the citizens' and communities' habits (the "software"). Specifically, the above-cited projects aim to stimulate communities to change their bad habits, pushing citizens towards more environmentally responsible mobility behaviors, driven by smartphone apps (Ben-Elia, Erev, & Shiftan, 2008; Kamal, Fels, & Fergusson, 2014). In fact, despite it is a common belief that mobility choices of people essentially depend upon prior commitments and available infrastructures (Urry, 2012), habits of people are also a key issue in transport patterns and performances. In light of this, the development of urban sustainable design models in the transportation domain often applies to the new communication technologies (Patier & Browne, 2010), due to their capability to intervene on the motivations that foster people to choose one or another urban transportation systems (Moore, 2011; Nasrudin & Nor, 2013). Starting from these considerations, solutions can be developed for the implementation and the rooting of more efficient and sustainable behaviors in urban transportation (Washbrook, Haider, & Jaccard, 2006). This implies that, other than by top-down policies, positive effects can also be obtained by bottom-up actions driven by citizens (Gatersleben, Murtagh, & White, 2013).

Using the 'Urban Metabolism' metaphor (Pincetl, Bunjeb, & Holmesc, 2012), in order of improving the "body" performance of towns, we should operate upon their 'nervous system', *i.e.* people that too often 'use' the city improperly (Wamsler & Brink, 2014). The behavior of people, in fact, is as a key element for realizing an integrated urban sustainable mobility, with a high attention on the role of the multimodality. On the other hand, a suitable regulation of the commuters' mobility patterns could positively affect the productivity of urban and metropolitan businesses (Shomo & Blei, 2016) and may limit the burdens of the transportation infrastructures.

The issue of how individuals plan their daily activities is as key point for understanding new tendencies of the urban mobility. The influence of economic and psychological factors, along with the 'livability' needs, explain how transportation systems interact with societal needs, including opportunities for recreation and social interaction (Goldman & Gorham, 2006). On the other hand, the economic contribution of people to the sustainability of cities has been also investigated with a special focus on the new mobility habits (Bullock, Brereton, & Bailey, 2017).

Beside the newly developed urban transport policies aimed at improving these actions, research works on the line "transport-values-communication-behaviors" are rapidly growing (Næss, 2013), while the increasing availability of large data sets and the use of suitable aggregated indicators have intensely enhanced the effectiveness of the analyses of the sustainability of urban transportation systems and their benchmarking (de Freitas Miranda & Rodrigues da Silva, 2012; Ying, Haoving, & Yichun, 2015).

In this domain, the use of new media-related technologies to modifying the citizens' urban transports habits (Gal-Tzur, Grant-Muller, Minkov, & Nocera, 2014) is getting increasing attention. Smartphones and other information management systems through personal mobile technologies show a great effectiveness due to the real time one-to-one dialogue with the citizens (Brazil & Caulfield, 2013; Iqbal, Choudhury,