



Promoting sustainable travel behaviour through the use of smartphone applications: A review and development of a conceptual model



Alfred Andersson^{a,*}, Lena Winslott Hiselius^a, Emeli Adell^b

^a Lund University, Department of Technology and Society, P.O. Box 118, SE-221 00 Lund, Sweden

^b Trivector Traffic, Aldermansgatan 13, SE-222764 Lund, Sweden

ARTICLE INFO

Keywords:

Travel behaviour
ICT
Smartphone applications
Behaviour change
Sustainable mobility

ABSTRACT

The negative effects of transport in terms of pollution, congestion and climate change has urged the need for higher shares of cleaner and more efficient modes of transport, especially in urban settings. While new technology can solve some of these issues, behaviour changes has also been identified as an important factor to achieve a modal shift from cars to walking, cycling or public transport. This study investigates how ICT has been used to influence behaviour change and synthesizes key aspects into a conceptual model for creating a behaviour change support system (BCSS) for smartphone applications. A literature review concerning behaviour change and ICT in the fields of transport, health, energy and climate was conducted to gather empirical evidence which forms the foundation of the conceptual model. The empirical findings were tested and verified against a theoretical framework consisted of The Transtheoretical Model, Theory of Planned Behaviour, Diffusion of Innovations and the concept of Gamification. The results suggest that customization to the user, relevant and contextualised information and feedback, commitment, and appealing design are important aspects when influencing users to behaviour change through smartphone applications. The conceptual model provides further knowledge of key aspects to consider when developing persuasive tools that aims to encourage more sustainable modes of transport.

1. Introduction

The global transport sector accounts for 23 percent of CO² emissions from fossil fuels, and is the sector that contributes most to global warming after electricity and heat production (IEA, 2016). While measures such as energy efficiency, higher incorporation of renewables in the fuel mix and increased production of renewable energy have led to a slower rate of growth of electricity and heat generation emissions, measures to reduce CO² emissions from the transport sector have not been as effective. Since 1990, global emissions from transport have increased by 71 percent (IEA, 2016).

For Sweden, conversion to a low-carbon energy system has accelerated faster in relation to the rest of the world, thanks to good resources in water and nuclear power, as well as the introduction of district heating instead of oil-based heating to housing. The industry mainly uses biofuels and electricity, however, energy use in transport is still dominated by petroleum and aviation fuel products (Sweden Energy Agency, 2015). Of Sweden's total emissions, transport constitutes one third, of which road traffic accounts for 93 per cent (Sweden Energy Agency, 2015; Environmental Protection Agency, 2016).

At the beginning of 2017, the government presented a proposal for a new climate law, aiming to reduce emissions by 85 percent by 2045 in Sweden, compared with 1990 levels. They also proposed to set a target that emissions from domestic traffic should have decreased by 70 percent by 2030, compared to 2010 levels (Government Offices of Sweden, 2017).

Research has shown that technology, innovation and economic factors alone will not suffice to achieve the climate and environmental objectives set for the transport sector (Nilsson et al., 2013). Sustainable development also requires changes in our behaviour and a development in which car travel decreases (Hiselius and Rosqvist, 2016). According to Anable et al. (2006) there is often a gap between individuals' concerns of climate change and the actual travel behaviour that is performed. It does not, therefore, need to be inadequate knowledge of climate change which is the main problem, but rather how it is translated into practice when choosing modes of transport.

To deal with the inefficient use of transport capacity, Transport Demand Management (TDM) emerged as a concept for restricting access for car traffic and reallocating space in favour for walking, cycling and public transport (Banister, 2011). From this, a similar approach

* Corresponding author.

E-mail address: alfred.andersson@tft.lth.se (A. Andersson).

referred to as Mobility Management (MM) has become an increasingly common tool, especially in Europe, in the past 20 years to achieve different transport goals (Litman, 2010). It is a concept for encouraging sustainable transport and managing the demand for car journeys by changing travellers' attitudes and behaviours (Van Acker, Van Cauwenberge and Witlox, 2013). Mobility Management is often referred to as soft actions as the concept rarely includes, however complements, infrastructure solutions and thus focusing on information campaigns, price mechanisms and policies (Litman, 2010).

As digitization begins to influence more community functions, new opportunities emerges for what information and communication technology (ICT), can be used for. A relatively new area is the use of smartphones as a platform for performing Mobility Management actions and influence travel behaviours (Semanjski et al., 2016). A number of studies have investigated ICT and collection of travel data (Wells et al., 2014; Gerike et al., 2016; Semanjski and Gautama, 2016) and some have also evaluated its potential for behaviour change and a tool for promoting sustainable modes of transport (Parvaneh et al., 2014; Poslad et al., 2015; Castellanos, 2016).

Earlier research on Mobility Management often includes behavioural and attitudinal theories (see for example Anable et al., 2006) to answer questions related to the attitude-behaviour gap, where consumers express concerns about environmental issues but fail to translate this into sustainable actions (Anable et al., 2006). A range of different techniques to induce voluntary travel behaviour change has also been developed over the years, such as personalized travel plans (PTP), individualized marketing schemes and organisational travel plans, to mention a few (see Cairns et al., (2008) for an ample review). While the intentions for this study is similar to those investigating how to optimize Mobility Management campaigns, it also aims to expand the knowledge on how to further influence mobility behaviour through smartphone applications, with support in theory. This could be described as an integrated four-step procedure, which includes adopting, shaping, changing and keeping sustainable travel behaviours with assistance of app-technology. This approach offers new possibilities as well as new challenges. By combining behavioural change techniques (BCTs) (Abraham and Michie, 2008) and ICT, research can start experimenting with the opportunities to gamify data and visualize messages differently to appeal to the user. However, fundamental but equally important challenges exists such as getting the targeted population to actually use the application in question. This extended approach demands for a wider scope of theories to be used, certainly behavioural change theories but also theories linked to gaming and adoption of new technologies.

In a recent review of persuasive technologies to promote sustainable mobility, also called behaviour change support systems (BCSS) (Oinas-kukkonen, 2010), Sunio and Schmöcker (2017) concludes that too little effort is given on grounding BCSSs in explicit behavioural change theory. Developing a successful BCSS depends not only on the creative and appropriate implementation of the behaviour change techniques, but also on explicitly grounding it on established theoretical constructs from behavioural theories (Arnott et al., 2014). Support for this suggestion can also be found in a significant meta-analysis by (Webb et al., 2010), who argues that a thoroughly rooted BCSS in theoretical foundation is positively correlated with its effectiveness. The potential for smartphone applications as carriers of behaviour change messages should, we argue, not be stalled by ignoring the underlying mechanisms of behaviour change developed from theory.

To the best of our knowledge, so far, the only BCSS grounded in behavioural theory is one called Quantified Traveller (Jariyasunant et al., 2015) which is based on Theory of Planned Behaviour (Ajzen, 1991). Although highly influential in the field of travel behaviour, TPB has been criticized for disregarding the time dimension of behaviour change, which is the mere foundation of other behaviour change theories, like The Transtheoretical Model (Prochaska and DiClemente, 1982). In TTM, change is defined as an incremental, gradual and

dynamic process, involving progress through a series of stages. It has been argued that a combination of continuous models and stage models, such as TPB and TTM, can help to explain the process of behaviour change (Forward, 2014). For this purpose, we used a theoretical framework consisting of both Theory of Planned Behaviour and The Transtheoretical Model but also Diffusion of Innovations (Rogers, 1995) and the concept of Gamification (Deterding et al., 2011) to review the content of previous research on behaviour change and ICT and draw conclusions about best practices for developing a BCSS.

There are currently expectations that ICT could be a useful tool for influencing travel behaviours (Brazil and Caulfield, 2013) and earlier research has asserted future platforms for persuasion and behaviour change to be mobile (Fogg and Eckles, 2007). However, there is a lack of research exploring these new platforms for behaviour change in the light of actual behaviour change theory, as pointed out by Klein et al. (2014) as well as Sunio and Schmöcker (2017). It is this knowledge gap in the research that this study seeks to investigate. The authors of this study has conducted a review of previous research on behaviour change and ICT. Apart from providing an overview of one particular field, the rationale for writing a literature review paper is also to add value (Wee and Banister, 2016) which in this study is performed through applying theories on research findings as well as synthesize the results into a conceptual model.

1.1. Purpose and research questions

The purpose of the study is to investigate how behavioural change techniques can be implemented in smartphone applications to encourage sustainable travel behaviours. This by (1) examine conclusions from previous research in which the combination of behavioural change techniques and ICT has been studied in the field of transport as well as in other areas, and (2) using a theoretical framework consisting of The Transtheoretical Model, the Theory of Planned Behaviour, Diffusion of Innovations as well as the concept of Gamification, to analyse empirical findings and thus increase the knowledge of how behaviour change support system (BCSS) could be improved.

The aim is to provide knowledge of key aspects to consider when combining behaviour change techniques with ICT and to develop a conceptual model that highlights these aspects, grounded in previous research and theory.

2. Theory

To analyse the results extracted from the literature review we applied the theoretical framework on the stages of adopting, shaping, changing and keeping sustainable travel behaviours with the use of smartphone applications. We made the assumption that these four stages are vital to consider when developing a BCSS, from adopting the tool to recognizing the new behaviour as a habit. Although this division makes for better theoretical overview, in reality we consider them very much integrated, both in practice and in theory. However, as a theoretical overview our approach can be described as in Fig. 1. By taking this approach we seek to get a holistic, theoretical perspective on developing a BCSS, as requested in previous research (Klein et al., 2014; Sunio and Schmöcker, 2017). With "Adopting" we refer to the crucial process in which the user utilize the smartphone application and engage with its content. Although many people today interact with smartphones (in Sweden, 81 percent have access to a smartphone and 65 percent use it daily), there is still a large proportion, especially among elderly, who struggle with adopting the new technology (Findahl and Davidsson, 2016). We acknowledge this limitation for the general adoption of a BCSS. There is however a strong increase in smartphone ownership worldwide (Pew Research Center, 2016). "Shaping" is where the application should inspire the user to contemplate about her/his current attitudes towards mobility and consider how their personal mobility could be more sustainable. "Changing" is the process in which

Download English Version:

<https://daneshyari.com/en/article/6576330>

Download Persian Version:

<https://daneshyari.com/article/6576330>

[Daneshyari.com](https://daneshyari.com)