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Comparing drivers' self-perception on driving behaviour changes with real world driving performance data: Lisbon case-study

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ABSTRACT

Information and communication technologies (ICT) applied to the transportation sector have enabled studying real-world driving behaviour and the impacts of eco-driving training and education on fuel consumption and driving performance. The aim of this paper is to assess drivers' self-perceptions on their driving performance after an experimental on-road monitoring trial in which they received feedback on performance. Drivers' self-perceptions on their driving performance were compared with their driving data.

Results indicate that majority of drivers considered the information presented in the feedback reports as being important, particularly in what concerned fuel consumption (fuel spent while driving) and aggressiveness (extreme braking and acceleration) indicators. Nonetheless, the same level of importance is not given to indicators that largely influence or not paying any attention to them when driving. Such results might be indicative that participants give preference to fuel efficiency when driving, having the intention to improve fuel consumption, but might find it difficult to understand and apply eco-driving techniques.

The majority of drivers perceived their behaviour suffered 'little' to 'some changes', particularly in fuel consumption and aggressiveness. The comparison with driving data revealed that drivers increased the incidence of unwanted behaviours when they considered that their performance suffered 'some changes'. On the contrary, decreases in some indicators, such as aggressiveness, speeding and excess rpm, were observed when 'no changes' were perceived by the drivers. These results are indicative that drivers are not correctly aware of changes in their performance.

1. Introduction

The road transportation sector is responsible for a major share of final energy consumption with values reaching, in 2013, 82% and 81% in Europe and Portugal, respectively (EUROSTAT, 2014). The transportation final energy consumption has been decreasing in Portugal since 2010. Between 2010 and 2013, a decrease of 12.6% has been observed and, from 2012 to 2013, this decrease was of 2.4% (EUROSTAT, 2014). Regarding CO_2 emissions, in 2012, road transportation was responsible for 94% and 96% of the total emissions of the transportation sector in Europe and Portugal, respectively. Between 2000 and 2012, a decrease of approximately 13% was observed in road transportation emissions, in Portugal (EUROSTAT, 2014). Despite the fact that final energy consumption of transportation sector has been slightly decreasing since 2009, it still has been the fastest growing consumer of energy and producer of greenhouse gas (GHG) over the last years. This can be explained by economic growth, development of more efficient individual transportation modes, take-up of alternative fuels and of consumers' lifestyle choices (EUROSTAT, 2012). The issue of driving behaviour assessment and promotion of changes in behaviour has been rising over the last decades as a solution to mitigate energy consumption and emissions with positive results. Nonetheless, it is also important to complement it with drivers' self-evaluation on their performance and what motivates them to change towards a more energy and overall efficient performance. Different types of programs focused on education, feedback, regulation and enforcement, targeting different aspects of driving behaviour (e.g. speed, acceleration/deceleration, idling, etc.) may help the driver change behaviour leading towards reductions in emissions and to improvements in fuel efficiency (Handy and Krizek, 2011). Understanding drivers' motivation towards change becomes important, but it is also essential to assess their self-perception/evaluation concerning their performance due to overestimation of driving skills with drivers rating themselves as more competent than the average driver, which can lead to the adoption of unsafe driving

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behaviours.

The rise of driving efficiency measures, such as eco-driving techniques, is essentially related with their ability to be applied to any type of vehicle type (e.g. conventional internal combustion, electric vehicles, buses, among others) with relatively low investment cost (Project, 2013; Killian, 2012). Eco-driving is a training program that provides drivers with educational tools to become more environmentally friendly and, therefore, to drive more efficiently and in a safer way as well. Eco-driving advocates the adoption of certain driving practices such as anticipation of traffic flow, the ability to shift gears up as soon as possible and to keep a steady speed, decelerate smoothly and to manage extra energy use with care, like air conditioning, among others (Project, 2013; Helena Strömberg et al., 2015). Several studies have been performed to assess the impact of eco-driving in driving performance, in both experimental and simulation conditions and with improvements in fuel consumption between 3% and 25% (Rolim et al., 2014; Beusen et al., 2009; Pampel et al., 2015; Tulusan et al., 2012; Barth and Boriboonsomsin, 2009; Strömberg and Karlsson, 2013). Nonetheless, the adoption of efficient driving behaviours highly depends on the drivers' ability to learn and maintain behaviours but also on the motivation to embrace them. Even though eco-driving behaviours adoption has presented positive impacts on performance, evidences has been found regarding their maintenance over time, with drivers revealing difficulties in keeping behaviours for a long period (Beusen et al., 2009; Wälberg, 2007; Jamson et al., 2015; Rolim et al., 2016; Zarkadoula et al., 2007; Hickman et al., 2007).

This paper aims to assess drivers' self-evaluation and perception of their driving performance and behaviour changes after periodically receiving delayed feedback to promote efficient and eco driving behaviours. While self-perception assessment of driving performance has been addressed in several studies, this has been mainly done with questionnaires focused on driving issues in a general way and not on specific driving indicators, like fuel consumption, speeding, number of extreme brakes, accelerations, idling time, etc. Additionally, previous studies assessing driving behaviour and drivers' self-perceptions are based on simulated driving data and not on real world data. As such, this paper will combine real-world driving data and questionnaire results to assess drivers' self-evaluation and perception regarding driving behaviour changes. For this, data was collected through an on-road monitoring experimental study performed over a period of 6 months in which 22 drivers received weekly online feedback reports on their driving performance. At the end of the trial a questionnaire was conducted to assess self-evaluation and self-perceptions towards driving performance and how it changed after receiving feedback.

2. Self-assessment of driving behaviour and its impacts in driving performance

Having concerns on climate change might not mean that people understand what provokes it and how to revert it (Liverani, 2009). This contradiction is related to the role of habits and attitudes on behavioural changes (Goldenbeld et al., 2000) but also due to the power of social norms and tendency to "discount the future" (Cabinet Office Behavioural Insights Team, 2012). Additionally, discrepancies can be found between self-reported behaviour and actual behaviour due to people's social desirability (Robert Gifford, 2011). Self-assessment implies that an individual makes judgements and evaluations based on their knowledge. However, people might not be able to assess themselves in an accurate way and their assessments might be biased.

The comparison between drivers' self-evaluation and experts' evaluation revealed that a total of 95% of drivers assessed their performance to be better than the expert evaluation, revealing that drivers have low insights and self-awareness in what regards their driving skills presenting biased evaluation (Amado et al., 2014). Results from an online survey indicate that drivers generally perceive eco-driving behaviours as easy to adopt, with anticipation of traffic events being easier to adopt than driving at lower speed, shifting gears up and driving with in lower rpm, which were seen as more difficult to adopt (Delhomme et al., 2012). In a study to assess self-report driving behaviour changes after attending a driving education program, 75% of the drivers stated, on a telephone survey done between one and a half and four years later, that their driving habits changed after participating on the course (Nasvadi, 2007).

Most studies analysing self-assessments of driving performance do so asking drivers to compare their abilities with that of the average drivers, revealing that drivers tend to rate themselves as more competent that others (Sundström, 2005). A study evaluating older drivers' (aged 75 or older) perceptions on their driving abilities associating it with self-regulatory behaviour concluded that participants were more likely to state improvements of higher level skills and declines of lowest level skills, revealing an adequate self-assessment of changes in driving skills (Siren and Meng, 2013). Results from a study conducted in Virginia, USA, comparing results from improvement driving re-education program test with a self-assessment tool indicated that drivers who completed learning surveys in class presented higher scores on the follow-up test than those who did not. Drivers also reported changes in driving performance and distraction decreases while driving (Pierson, 2013).

Given the evidences that drivers tend to have an unrealistic self-evaluation of their driving performance, the implementation of on-road driving trials and availability training programs followed by feedback sessions stand out as potential solutions to ensure a more accurate assessment. Such solutions can play an essential role in the development of self-assessment skills and, therefore, enabling drivers to perform an accurate evaluation of their driving skills (Amado et al., 2014) and consequently change behaviour adopting safer and efficient behaviours. Regarding providing feedback on driving behaviours, evidence has been found on performance differing according with the type of feedback provided. For instance, feedback in the form of scores and grades with no explanation on how to improve has led to overestimations of performance and an additional sense of untrustworthiness on the driving assessment performed, meaning that providing drivers with detailed information and improvement advices can contribute to the effectiveness of feedback (Dogan et al., 2012). Drivers have also presented more favourable attitudes towards personalized and informative feedback (Vaezipour et al., 2016). Nonetheless, considering that drivers tend to overestimate their performance, when faced with no improvements after feedback is provided they depreciate the feedback provided and devaluate the credibility of the evaluation (Dogan et al., 2012).

3. Methods and data

The aim of the present study was to assess drivers' self-assessment on their driving performance and perceived behavioural changes after participating in an on-road monitoring trial and receiving delayed feedback promoting efficient and eco-driving behaviours.

3.1. Experimental design

The research presented in this paper is part of an experimental study performed to assess the impacts of delayed feedback on eco-driving behaviour and environmental performance changes. The study took place in Lisbon, Portugal, for a period of 6 months (from August 2014 to January 2015) with the participation of 40 drivers divided in two groups: 18 in the control group and 22 in the experimental group. None of participants received any training on eco-driving. After an initial characterization monitoring period (3 months), the drivers from the experimental group received weekly online feedback reports on their driving performance, focused essentially on the main indicators that influence efficient and ecological driving indicators: fuel consumption, aggressiveness (hard brakes and accelerations), speeding (above 120 km/h), excess rpm and idling time. The recommendation