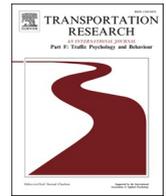


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Gamification and sensory stimuli in eco-driving research: A field experiment to reduce energy consumption in electric vehicles

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ABSTRACT

Gamification can create meaningful engagement for users and foster desired behaviors. In gamification research, however, the importance of sensory stimuli often has been overlooked. We examine and discuss how the variation of visual and auditory stimuli in gamified driving influences users' eco-driving behavior. We conducted a field experiment where eco-driving is the field of application and energy consumption the dependent variable. Participants performed test drives with a battery electric car whilst using a mobile application that supports participants to drive more eco-friendly. We varied the extent to which the application employs visual and auditory stimuli. Our results of an analysis of covariance (ANCOVA) and multivariate analysis of variance (MANOVA) show that, depending on the stimuli configuration, participants expose different levels of energy consumption and experience different levels of enjoyment as well as different intentions to actually use this mobile application. More specifically, through the ANCOVA, we find significant differences of the energy consumption between the control group, who drove without the gamified application, and the visual-auditory group, as well as between the visual-only and the visual-auditory group, both at a p-value of 0.02. Further, the MANOVA reveals significant differences between the visual-only and visual-auditory group at a p-value of 0.01 for both perceived enjoyment and intention to use. Due to the significant impact of the varied sensory stimuli on the outcomes, we conclude that the choice and design of sensory stimuli play an increasingly important role in real-time gamification in safety critical situations.

1. Introduction

The benefits of gaming are increasingly recognized as an asset to foster desired behaviors, which is why products and services that have not usually been associated with games, are becoming more and more *gamified*, meaning that game design elements such as leaderboards, challenges or badges are introduced into non-game application contexts (Deterding, Dixon, Khaled, & Nacke, 2011; Hamari & Koivisto, 2015; Putz, Hofbauer, & Treiblmaier, 2020; Suh, Cheung, Ahuja, & Wagner, 2017). Yet, most gamified applications are predicted to fail to meet corporate objectives, primarily due to poor design (Burke, 2013). This challenge has led to an interest in research that examines the design and evaluation of gamification (Morschheuser, Hassan, Werder, & Hamari, 2018; Mulcahy, Russell-Bennett, & Iacobucci, 2020; Rapp, 2017).

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