Transportation Research Part A 92 (2016) 26–42

Contents lists available at ScienceDirect

Transportation Research Part A

journal homepage: www.elsevier.com/locate/tra

How experience of use influences mass-market drivers' willingness to consider a battery electric vehicle: A randomised controlled trial

Stephen M. Skippon *, Neale Kinnear, Louise Lloyd, Jenny Stannard

TRL, Crowthorne House, Nine Mile Ride, Wokingham, Berks RG40 3GA, United Kingdom

ARTICLE INFO

Article history:
Received 17 April 2015
Received in revised form 18 May 2016
Accepted 30 June 2016

Keywords:
Electric vehicle
Consumer
Adoption
Randomised controlled trial
Symbolic
Performance

ABSTRACT

Uptake of electric vehicles (EVs) by consumers could reduce CO_2 emissions from light duty road transport, but little is known about how mass-market consumer drivers will respond to them. Self-Congruity theory proposes that products are preferred whose symbolic meanings are congruent with personal identity. Further, Construal Level theory suggests that only those who are psychologically close to a new product category through direct experience with it can make concrete construals related to their lifestyles; most drivers lack this for EVs. For instance, potential performance benefits of EVs might offset range limitations for consumers who have such direct experience. The effect of direct experience was tested in a randomised controlled trial with 393 mass-market consumer drivers. An experimental group were given direct experience of a modern battery electric vehicle (BEV), and a control group an equivalent conventional car. Despite rating the performance of the BEV more highly than that of the conventional car, willingness to consider a BEV declined after experience, particularly if the range of the BEV considered was short. The participants willing to consider a short-range BEV were those high in self-congruity, for whom the BEV could act as a strong symbol of personal identity.

1. Introduction

Electric vehicles (EVs) offer a potential option to reduce CO_2 emissions from light duty road transport. Their success, however, will depend critically on their uptake by mass-market consumer drivers (MMCDs). If they meet or exceed these consumers' needs, uptake is likely to be high, but if they fail to meet such needs, uptake could be low. The question of how mass-market consumers will respond to the various attributes of EVs is therefore of some importance. Vehicle performance and symbolic value can be important factors in car use decisions (Steg, 2005) and so may affect mass-market consumer drivers' willingness to consider BEV adoption.

To explore their potential influences, we report a large-scale randomised controlled trial to measure UK MMCDs' willingness to consider having a battery electric vehicle (BEV), their evaluations of the performance of a modern (2012) BEV, and their attributions of symbolic meanings to BEVs. The research design addressed three methodological issues relevant to research on uptake of new product categories: psychological distance, sample bias, and Hawthorne effects.

* Corresponding author.
E-mail addresses: sskippon@trl.co.uk (S.M. Skippon), nkinnear@trl.co.uk (N. Kinnear), lklloyd@trl.co.uk (L. Lloyd), jstannard@trl.co.uk (J. Stannard).

http://dx.doi.org/10.1016/j.tra.2016.06.034
0965-8564/

1.1. Evaluations of EV performance

It can be argued that BEVs could have better performance than ICE vehicles, and that this might help to offset adverse perceptions of limited range. Skippon (2014a) found that consumer drivers construe vehicle performance in terms of two independent dimensions, dynamic performance and cruising performance. There has been relatively little research to date on how drivers evaluate either aspect of the performance of BEVs. Axsen et al. (2013) reported that participants perceived the smoothness of the driving experience (cruising performance) with a BEV as a benefit. However there was a mixed response to dynamic performance, with fast acceleration at low speeds seen as a benefit, but poor overall acceleration as a drawback. Graham-Rowe et al. (2012) found that "drivers felt that the power and performance of the EV was substandard" (p. 145). Participants in the study by Skippon and Garwood (2011) rated acceleration from 0 to 30 mph as somewhat better, acceleration from 30 to 50 mph as similar, responsiveness as somewhat better, power as somewhat worse, smoothness when cruising as substantially better and noise when cruising as substantially lower than a conventional ICE car. The picture that emerged from these studies was that BEVs of the time were considered to have better cruising performance, and either worse or similar dynamic performance than ICE cars. However, all were uncontrolled studies with small or biased samples, using an early generation of BEVs, and, except for Skippon and Garwood (2011), qualitative evaluations.

1.2. Symbolism of EVs

Symbolic goals to signal personal identity to self and others are known to be important in consumer choices in general (Dittmar, 1992) and vehicle use in particular (Steg, 2005). A substantial part of the value of products, including cars, arises from the meanings they convey about the identities of their users. Heffner et al. (2007) studied symbolism in California's early market for hybrid electric vehicles (HEVs), finding that personal meanings signified by HEVs included being an ethical person, community orientation, concern for others, intelligence, maturity, sensibility, independence and individuality. Participants were early adopters of HEVs, so it is perhaps risky to extrapolate too much from these findings to the symbolism of plug-in EVs among MMCDs. Graham-Rowe et al. (2012) identified symbolic meaning as a major theme (referred to as *impression management*) in their participants' responses to the experience of using a BEV or PHEV. Drivers of EVs were perceived as being:

- People with limited mobility needs, for whom the restricted utility of a BEV would not be a problem, and who saw cars from a functional perspective.
- People who prioritise environmental concerns.
- People who derive social identity gains from being seen to adopt new technologies.

Most participants tended to distance themselves from the first two meanings, but saw the third in a positive light.

Skippon (2014b) used an attribution-vignette method to quantify the symbolic meaning of the major European categories of light duty vehicle (small hatchback, sports car, etc.) in terms of public attributions of personality traits using the five-factor model (Costa and McCrae, 1995; McCrae and Costa, 2003), plus status, gender, age, relationship investment, and physical attractiveness to a typical user of each category. This approach is based on Miller's (2009) evolutionary perspective that the ultimate symbolic meanings of a consumer product are the personality traits of its users, because products act in modern cultures as costly signals of reproductive fitness. The method draws on attribution theory (Hewstone, 1989; Jones and Davis, 1965; Kelley, 1967): when an actor is observed using a consumer product, the observer will attribute certain personality traits to the actor by inference from that behaviour. These traits will be those that the observer associates with the product, i.e. its symbolic meaning according to Miller. Skippon and Garwood (2011) used an early version of this method to characterise the symbolic meaning of BEVs. BEV users were seen by their small sample as being above average in the five-factor traits openness, conscientiousness, and agreeableness, and average in extraversion and neuroticism.

Self-congruity theory (Sirgy, 1982, 1985) predicts that people will tend to purchase consumer products whose symbolic meanings are congruent with their perceived self-identities. Schuitema et al. (2013) found that people with self-reported pro-environmental identities had more positive expectations of EVs than others, while those who saw themselves as authorities on cars did not.

This literature tends to suggest that EVs, and particularly BEVs, have symbolic meanings associated with pro-environmental identity, high openness, conscientiousness, and agreeableness. They also suggest that people whose self-identities are congruent with these meanings will be more favourably disposed towards EVs than those whose self-congruity is lower. However none of the studies measured the specific symbolic meaning of EVs compared to other vehicle types, or the relationship between self-congruity and potential uptake of EVs, with MMCDs who have directly experienced using an EV themselves.

1.3. Methodological issues for research on mass-market consumer drivers' responses to BEVs

To MMCDs, BEVs are currently a new, unfamiliar type of car. A number of methodological issues can limit the validity or generalizability of research on responses to "really new" product categories (Hoeffler, 2003). The study design addressed three methodological challenges that are relevant for research on responses to BEVs.