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ABSTRACT

Purpose

To investigate the effects of gamification on connections between consumers' self-image congruence in relation to the purchasers of an environmentally-friendly product (electric vehicles [EVs]) and (i) their possession of a stereotype of EV owners as being 'unconventional', and (ii) their attitudes towards EVs, having regard to their levels of environmental concern and prior knowledge of EVs. Additionally, the research explored the link between attitudes towards and willingness to purchase EVs.

Design/methodology/approach

Participants completed a questionnaire and an Implicit Association Test both before and after playing a computer game wherein the player assumed the identity of an EV driver. A structural equation model was constructed to predict attitude to EVs. The relationship between attitude and willingness to purchase was examined via a conditional process analysis.

Findings

The experience of playing the game improved the favourability of the respondents' stereotype of EV owners by an average of 19%, and their attitude towards EVs by 17%. Self-image congruence in relation to EV ownership increased on the average by 14% and reported EV product knowledge by eight per cent. However, willingness to purchase an EV was not substantially affected. The link between attitude and willingness to purchase was weak, but was significantly moderated by stereotype favourability and self-image congruence with EV owners.

Limitations

As with any IAT study, it was necessary to pre-specify a particular form of stereotype. Future research could employ alternative stereotypes. The investigation took place in a single country and involved a single environmentally-friendly product.

Implications

Gamification has much potential for helping manufacturers and government agencies to stimulate the mass market for EVs. In order to negate unfavourable images of EV owners, marketing communications promoting EVs might usefully employ celebrities, sports personalities and/or leading political figures as exemplars of the types of people who drive electric cars.

Originality

The research is the first to explore the effects of gamification on product user self-image congruence and stereotype formation. It is novel both in its employment of an IAT to measure the consumer stereotype of an environmentally-friendly product and in its examination of the moderating influences of stereotype and product user self-image congruence on the attitude-willingness to purchase link.

Key words: Stereotyping, self-image congruence, gamification, Implicit Association Test, attitude change, electric cars.

Introduction

A substantial volume of research has established that the stereotyping by members of the public of groups of individuals who buy particular kinds of products influences the stereotype holders' attitudes towards those products (see for example Wittenbrink, Judd and Park, 2001; Wegener, Clark and Petty, 2006; Bassili, 2008; Bashir et al., 2013). Studies have also concluded that the attitudes resulting from

stereotyping can affect a person's willingness to purchase the products in question (Hini, Grendall and Kearns, 1995; Peter and Olsson, 2008; Johnstone and Hooper, 2016). The term 'product user image' (PUI), i.e., the 'stereotypic image of the generalised product user' (Sirgy, Johar and Claiborne, 1992 p.402), describes a consumer's image of purchasers of a specific kind of product. Product user image has been found to impact strongly on some consumers' attitudes regarding the qualities of the products bought by a stereotyped group (Jamal and Goode, 2001; Kressman et al., 2006; Bassili, 2008). It is known moreover that the match between a person's actual or ideal self-concept and the same individual's image of purchasers of a certain type of product, i.e., the person's 'self-image congruence' with buyers of that kind of product (Sirgy, Johar, Samli and Claiborne, 1991) can influence an individual's attitudes towards the type of product involved (see Grewal, Mehta and Kardes, 2000; Farhat and Khan, 2012).

The current research examined the proposition that a specific (negative) stereotype of the owners of a particular environmentally-friendly product, i.e., electric vehicles (EVs), that possibly is held by many people who have no experience of EVs can affect the latter's attitudes towards EVs, but that the negative stereotype can be changed by a non-EV owner playing a game within which the individual assumes the identity of an EV driver. The study also considered the nature of the connection between game players' pre- and post-game attitudes concerning EVs and their inclinations to purchase an EV. An Implicit Association Test (IAT) was used to measure the strength of EV non-owners' assumed stereotype of EV owners. This presumed stereotype entailed the negative perception that owners of EVs are somewhat 'unconventional' when compared with an alternative stereotype wherein non-EV owners are assumed to possess more conventional attributes. A model was constructed in which stereotype formation was posited partially to depend (alongside an individual's prior knowledge of EVs and degree of environmental concern) on the congruence of the person's self-image vis-à-vis owners of EVs.

The research described below contributes in several ways to what is known about connections between product user image vis-à-vis environmentally-friendly consumption, attitude formation and attitude change, and about the link between attitude and willingness to purchase. It explored, in the context of an environmentally-friendly product (electric cars), the effects of game playing on (i) self-image congruence with owners of EVs, (ii) stereotype and attitude change, and (iii) EV product knowledge: lines of enquiry that to date have received scant attention in the academic domain. Also, prior academic research has not considered environmental concern and product knowledge as primary potential antecedents of stereotyping and self-image congruence. A further novel feature of the research is its application of an Implicit Association test to measure consumers' stereotypes of users of an environmentally-friendly product, thus seeking to minimise social responsibility bias among the study participants. Many past attempts to establish a significant link between attitudes towards an environmentally-friendly product and intention to purchase the product have failed to demonstrate a significant connection (see Bamburg [2003]; Joshi and Rahman [2015]; and Hassan, Shiu and Shaw [2016] for reviews of literature concerning this matter). The present study explored the attitude-willingness to purchase link in relation to electric cars by testing hypotheses that the connection may be moderated by self-image congruence with owners of EVs and by non-EV owners holding a certain kind of stereotype of EV drivers.

Electric vehicles

The European Union, the government of the United Kingdom and the public authorities of numerous western nations recognise the need to increase the uptake of EVs among the driving public (for details see Garling and Thogersen, 2001; Houses of Parliament, 2010; Burgess, King, Harris and Lewis, 2013; OLEV, 2013; Heyvaert, Coosemans, Van Mierlo and Macharis, 2015; Bennett, Shaw and Kottasz, 2016). In the EU, for example, regulations to limit average emissions from new cars were introduced in 2012, setting a target of a 40% reduction in average EU tailpipe emissions by the year 2020 based on 2009 levels. Likewise, the UK's Climate Change Act of 2008 committed the country to cut greenhouse gas emissions by 80% by the year 2050, including an 80% reduction in transport emissions (Houses of Parliament, 2010). Most national authorities consider EVs to be the cleanest of

all vehicle technologies, possessing great potential for reducing air pollution and Co2 emissions (Bunce, Harris and Burgess, 2014), and offering many benefits to motorists, e.g., low maintenance and running costs (Garling, 2000), excellent performance (exemplified by speed, power and manoeuvrability), reliability, comfort, and low noise levels (Egbue and Long, 2012; Shaw and Bunce, 2015). In the UK, the government offers a £5000 subsidy (plus tax benefits) to people who purchase EVs in order to make such vehicles affordable compared to petrol or diesel-powered cars. Nevertheless, members of the public routinely associate EVs with the existence of difficulties such as their relatively short driving range, the poor availability of charging points and slow charging processes (Shaw, Bunce and Kottasz, 2014). Studies in a number of countries have confirmed this view. Junquera, Moreno and Alvarez (2016) for example found that drivers in Spain voiced many concerns about the technical aspects of EVs, notably battery life, charging times and driving range. Likewise, a survey of 607 motorists in Hefei, China completed by Han, Wang, Zhao and Li (2017) concluded that, whereas perceptions of functional attributes of EVs (performance, convenience, etc.) exerted strong direct and indirect effects on EV purchase intention, non-functional aspects had only indirect influences. (For general reviews of factors influencing consumer usage intentions vis-à-vis electric cars see Burgess et al. [2013]; Song and Ali Bekhet [2015]; Bennett et al., 2016; Li, Long, Chen and Geng [2017].)

Internationally, the need to increase the number of EVs on the roads has been a matter of substantial concern since, although one million EVs had been sold worldwide by mid-2015, this represented less than 0.1% of the 1.2 billion vehicles currently in existence (Cobb, 2015). Only 310,000 EVs were registered in all of Western Europe between 2010 and 2015, mainly in Norway and the Netherlands. Within the UK, successive governments have acknowledged that achieving vehicle emission targets requires the widespread adoption of electric vehicles, implying the need for the market for EVs to be developed extensively and immediately. Accordingly, the government implemented in 2013 (among other initiatives), a national campaign to raise public awareness of the benefits of zero and ultra-low emission vehicles. This resulted from the UK government's recognition that 'as yet most people have little if any knowledge of these new vehicles' and that 'insufficient or inaccurate information can put off potential buyers' (OLEV, 2013 p.10). A number of studies reviewed by Burgess et al. [2013] confirmed the government's view, indicating that UK consumers are generally ignorant of how EVs work, of the EV driving experience and of the financial implications of buying an electric car. As an additional measure the UK government announced in 2014 a grant of £2.5 million to a group of five leading EV manufacturers (BMW, Nissan, Renault, Toyota and Vauxhall) to help them execute a marketing campaign both to educate the public about EVs and to improve the general public's image of EVs and of the characteristics of the people who purchase them (Hinks, 2014). The latter public image problem has been identified by government agencies as a significant barrier to the stimulation of EV sales (Houses of Parliament, 2010, OLEV, 2013, Burgess *et al*., 2013, Bennett, Shaw and Kottasz, 2016).

Literature review and theoretical foundations

It is known that emotions can play a critical role in attitudes and behaviour concerning EVs. Emotions, in the words of Cabanac (2002) are 'conscious experiences characterised by intense mental activity and a high degree of hedonic content' (p. 69). A substantial body of literature asserts that affectively pleasing emotions can create positive attitudes towards and judgements about items, which may be seen as more effective (Norman, 2005). Attitudes, according to Norman (2005) can be influenced by visceral (affective), reflective (cognitive) or behavioural factors (the last of these sometimes resulting from past experiences). Moons and De Pelsmacker (2012) observed how emotional factors such as self-image and identity, sense of satisfaction with contributing to a cleaner environment, and believing that one is an opinion leader could be more important in forming EV attitudes and behaviour than rational arguments. Indeed, according to Schuitema, Anable, Skippon and Kinnear (2013) and Rezvani, Jansson and Bengtsson (2017), the *anticipated* emotional pleasure (a behaviourally related influence – see Norman [2005]) available from owning an environmental-friendly product such as an electric car can encourage purchase. Schuitema et al. (2013) found that emotions of pleasure, pride and (negatively) embarrassment were associated with EV ownership;

while Graham-Rowe et al. (2012) observed the presence of emotions of 'feeling good', less guilt, and (sometimes) embarrassment among people undertaking EV test drives. Heath and Scott's (1998) review of motives for purchasing automobiles (of all types) concluded that many people buy cars they believe possess symbolic images 'similar and/or complimentary to the image they hold of themselves' (p.1110). According to this line of thought some individuals might obtain an EV to express their self-identity, to help create a certain self-image, and to be seen as environmentally friendly (see Ozaki and Sevastyanova, 2011 for details of relevant literature supporting these propositions).

The present study focused on emotions associated with self-image, negative stereotyping and the desire to protect the physical environment. Three major streams of theory underpin the current research, i.e., theories of self-image congruence with users of a certain product, of stereotype change, and of gamification. Theoretical propositions concerning the effects of environmental concern and product knowledge are also relevant to the investigation.

Self-image congruence with users of a certain product

Studies in this area (see for example, Sirgy, 1986; Sirgy et al., 1992; Jamal and Goode, 2001; Kressmann et al., 2006; Farhat and Khan, 2012; Hosany and Martin, 2012) have typically conceptualised four varieties of self-image congruence (SIC) with users of a certain product (referred to as product user self-image congruence), i.e., 'actual', 'ideal', 'social' and 'ideal social'. Actual product user SIC, according to Sirgy et al. (1992) is the goodness-of-fit between a person's PUI and the person's actual self-image, whereas ideal product user SIC is the match between PUI and the individual's ideal self-image, i.e., how the person would *like* to see him or herself, rather than how the individual actually sees him or herself. Social product user SIC relates to connections between PUI and how consumers believe they are seen by others, while ideal social product user SIC refers to how they would *like* to be seen by others. Sirgy (1986) argued that high levels of any one of these forms of product user SIC is capable of motivating a person to think positively about a product, as each one can satisfy a particular consumer need. High actual product user SIC allegedly gratifies an individual's need for self-consistency, i.e., the desire to act in ways that are in accord with the person's beliefs about him or herself and the individual's values, lifestyle and preferences (Rosenberg, 1979). A high level of ideal product user SIC helps satisfy the need for self-esteem, i.e., the need to behave in ways that maintain or increase positive self-regard. High social product user SIC fulfils the need for social consistency, i.e., ensuring that the person's attitudes and/or behaviour will not violate the individual's social self-image or identity (Baumeister,1982). Ideal social product user SIC relates to the need for social approval by others.

Many studies have concluded that, in the words of Jamal and Goode (2001 p. 482) strong product user SIC 'facilitates positive attitudes towards products and consequently affects purchase intentions' (see Kressmann et al. [2006]; Farhat and Khan [2012] for information on literature concerning this matter). Heath and Scott (1998) pointed out that many people buy a product because of the product's symbolic meaning in relation to its capacity to complement an individual's self-image, thus helping a person achieve self-image congruence. This has been found to be especially true in relation to purchases of motor vehicles (for details see Sedikides and Gregg [2008]; Axsen, Hageman and Lentz [2012]; Schuitema et al. [2013]). Burgess et al. (2013) reviewed a number of studies which concluded that symbolic meanings were frequently attached to owning a certain type of car and that often these meanings would 'override more rational, utility-based considerations' (p. 33). Given that a vehicle purchase can 'express who I am' (Skippen and Garwood, 2011 p.527) and may reflect an individual's 'self-identity, social status and a number of other personal characteristics' (Burgess et al., 2013 p. 34), it follows that types of vehicle typically owned by a category of people that is viewed negatively are unlikely to be regarded in a favourable manner (Hyatt, 1992; Oyserman, 2009). Affiliation with a group, e.g., by purchasing a product owned by many members of a group that is seen to possess disagreeable attributes, may cause dissonance that could damage a person's self-concept (Sedikides and Gregg, 2008).

Theory of gamification

Gamification entails the application of elements of game design to other areas, often as a marketing technique to encourage players' learning and engagement with a product or service (Robson *et al.,* 2015). Gamification is increasingly recognised as an important research tool for consumer research (McCarthy, Pitt, Robson and Kietzmann, 2014]; Mekler, Bruhlmann, Tuch and Opwis, 2017). Significant contributions of gamification research to the consumer behaviour literature have concerned the development of product knowledge and consumer awareness of brand names (e.g., Nelson, 2002; Yang, Asoad and Dwivedi, 2017), consumer engagement (e.g., McCarthy et al., 2014) and hence emotional connections between consumers and brands (cf. Rappaport, 2007) and brand loyalty in respect of attitude and repeat patronage (e.g., Insley and Nunan, 2014). The potential for synergy between gamification and relationship marketing has featured prominently in gamification literature (see Luccasen and Jansen, 2014). Harwood and Garry (2015), for instance, argue that a primary driver of gamification within consumer research is the provision of experiences that trigger emotions that induce attitudes and behaviours similar to a gameplay, culminating in a positive relational outcome. Gamification also has valuable applications in social marketing (see Mitchell, Schuster and Drennan [2017] for information on recent studies). Mulcahy, Russell-Bennett and Rundle-Thiele (2015) noted that the experiential value offered by gamification helps contribute to the generation of awareness, engagement, positive image and perceived quality, all of which lead to loyalty thus supporting target audiences' uptake of social behaviour change.

A game can be used to (i) introduce a person to a product or activity the individual has not experienced previously (Burke, 2014), (ii) develop within the player new frameworks for understanding (Lee and Hammer, 2011), (iii) stimulate curiosity about a product, and (iv) encourage emotional involvement with a product (Sailer, Hense, Mandel and Klevers, 2013). Through playing a game based on a product the player learns about the product (Landers, Bauer, Callan and Armstrong (2015). This learning is facilitated via greater retention of information (due to the player's interest in the topic of the game – see Landers et al. [2015]), through the player having a more intense focus on the product, and because relevant information is provided to the player in a 'non-threatening and gradual way leading to enhanced learning' (Freudmann and Bakamitsos, 2014 p.570). A review of empirical studies of gamification undertaken by Hamari, Koivisto and Sarsa (2014) found that the gamification of activities that involved learning typically led to positive learning outcomes. Moreover, according to Hamari et al. (2014), game playing can be used to facilitate changes in attitude concerning the product or activity involved. The player *experiences* within a virtual context the product or activity featured in a game; interacts and empathises with using the product or the completion of the activity (Huber and Hilty, 2014); is directed to think about the properties of the product or activity (Burke, 2014; Landers et al., 2015) and discovers its qualities (Sailer et al., 2013). Often, positive feelings about the featured product or activity will arise from game-playing (Sailer et al., 2013), sometimes leading to high levels of willingness to purchase (Bittner and Shipper, 2014). In the present study, a game involving a simulated journey in an electric car was used to arouse a player's curiosity about EVs, to enable a person without any experience of driving an EV to learn about EVs and to understand their qualities. The player's engagement with the game and the learning that might result was hypothesised to arouse positive feelings about EVs and to engender attitudes that might increase an individual's willingness to buy an electric vehicle. It was further posited that if a person had negative views concerning existing EV owners and/or felt that EV ownership was not compatible with the individual's self-image, then the process of playing the game and hence becoming involved with EV driving, would change these views and feelings in a positive direction.

Stereotypes of EV owners

A stereotype is a generalised belief (often oversimplified, exaggerated, inaccurate, and resulting from incomplete information [see Patterson, 1991]) about individuals belonging to a certain group (Kanahara, 2006). Stereotyping can influence how an individual processes

information, may bias interpretations, and consequently may have an impact on attitudes and behaviour (Wegener et. al., 2006). A stereotype can develop explicitly (e.g., via conscious observation followed by attributions of characteristics to all the members of a group) or implicitly (unconsciously) and without the person being aware of holding the stereotype (Greenwald and Banaji, 1995). Unconscious stereotyping may arise from influences that a person does not know exist, but which subsequently affect the individual's attribution of specific qualities to the stereotyped group and hence lead to certain attitudes concerning the group (Wittenbrink et al., 2001). Attitude formation resulting from stereotyping can be rapid (Shih, Pittinsky and Ambady, 1999), strong (Bassili, 2008), highly simplistic and biased (see Forbes and Schmader [2010] for information on literature pertaining to this matter).

Possible public perceptions of EV owners

Some members of the public are known to hold favourable stereotypes of EV owners, characterising them as 'ethical, caring about the environment, and forward thinking' (Burgess et al., 2013 p.34; see also Kurani, Turrentine and Heffner, 2007), and/or as socially aware and technologically advanced individuals who exhibit responsibility for future generations. However, a considerable amount of research (accompanied by a substantial volume of published practitioner opinion) has suggested that many members of the public view EV owners negatively. For example, Burgess et al. (2013) reported survey data from several academic studies which concluded that the stereotype of EV drivers among individuals without knowledge or experience of EVs tends to be unfavourable. Extreme versions of the negative stereotype noted by Burgess et al. (2013) included impressions that many EV owners are 'ineffectual idealists, political radicals, hypocrites who enjoy showing off, tree huggers, or dull people with limited mobility needs' (p. 34). EV owners, Burgess et al. (2013) continued, frequently thought they were a target for humour. Graham-Rowe et al. (2012) questioned 40 UK non-commercial drivers about how they believed other people would see them if they bought an EV. The majority of the respondents thought they would be regarded as boring, lacking a sense of fun, and living a slow-moving lifestyle. Manufacturers of EVs have also reported concerns about the likely existence of negative stereotypes of EV owners. For instance, a (UK government supported) consortium of 12 EV manufacturing companies formed (under the name *The Charging Point*) to promote EVs complained in 2011 that 'for many people, the term "electric vehicle" conjures up images of cars that are as cool as corduroy jackets with elbow patches, people riding mobility scooters, or some ridiculous town runabout made of old milk containers' (Conway, 2011 p. 1). Among the most biased members of the public, the consortium continued, owners of EVs might even be seen as 'swivel-eyed, hemp-chewing leftie loons' (p.1). Further derogatory views of EV owners reported in the practitioner literature are that EV owners can be 'aloof, over privileged and smug' (Bloomfeld, 2012), 'hopelessly boring' and 'lame' (Frawley, 2012 p.1). A potential reason for such prejudice, according to Conway (2011), is an historical connection in the public mind between EV owners and unfavourable images of environmentalism, considering the 'common perception' that 'a few years back electric cars were driven by a fair number of people with an active environmental agenda' (p. 1) (see also Bekiroglu and Ozmen, 2010). Media portrayals of the environmental movement have often been deprecatory; focusing on presumptions that environmentally active people exhibit unconventional lifestyles, political non-conformism and anti-establishment attitudes (Hansen, 2003; Berkiroglu and Ozmen, 2010). Media representations of this nature, in the words of Bashir et al. (2013), could result in 'resistance to environmentally related behaviour change' (e.g., buying an EV) (p. 614). The present study examined the antecedents and consequences of a negative rather than positive public stereotype of owners of EVs.

Changing a stereotype

Research has indicated that stereotypes are not immutable and can be changed as people are presented with particular contextual cues (see Dasgupta and Greenwald [2001] for reviews of empirical studies confirming this assertion). In particular, studies have concluded that stereotype change can be brought about by bringing individuals into direct contact with a stereotyped group (Snyder, 1981; Brendl, Markman and Messner, 2001), and/or by furnishing stereotype holders with relevant information and explanation (Smith and Mackie, 2007; Hamilton et al., 2015). In the current investigation, stereotype change was investigated by having non-EV owners play a game wherein the player drives a virtual EV on a simulated journey and, in the process, is exposed experientially to all key EV aspects.

The game begins with the player virtually sitting in an EV's driving seat and looking through a windscreen at the road ahead. Pressing a key on a computer keyboard starts the vehicle for a journey through a built-up urban location. The journey lasts about eight minutes and includes a traffic jam, a diversion, left and right turns (activated by pressing relevant keys), and the need to negotiate around some road works. During the journey the player periodically receives voice-over information about time to recharging, charge duration, fuel cost savings, vehicle range, the performance advantages of EVs (fast and smooth acceleration, etc.), the government EV purchase subsidy, an EV's silent and comfortable running, easy controls, extra cabin space, and so on. The game (developed by a professional game creation company) enables players to experience and explore the identity of an EV driver, thus impelling players to reassess the accuracy of their interpretations of EVs and of the people who drive them (cf. Snyder, 1981). During the game the player is (i) confronted with evidence not always considered by non-EV drivers, (ii) encouraged to empathise with EV drivers, and (iii) *learns* about EVs (cf. Crocker and Weber, 1983).

The considerations discussed in previous sections suggest:

Hypothesis 1. High product user SIC relating to ownership of EVs causes (a) a favourable stereotype of EV owners, and (b) favourable attitudes towards EVs.

Hypothesis 2. Playing the game will positively affect a person's (a) product user SIC in relation to EVs, (b) stereotype of EV owners, (c) attitude towards EVs, and (d) willingness to purchase.

Hypothesis 3. A negative stereotype of EV owners causes unfavourable attitudes towards EVs.

Additional possible influences on attitude, SIC and stereotyping of EV owners

Two further variables are posited to affect (i) a person's attitude towards EVs, (ii) the individual's product user SIC, and (iii) the degree of negativity of a non-EV owner's stereotype of EV drivers; namely environmental concern and prior knowledge of EVs. The former because research has established that strong concern for the environment can exert powerful influences on consumption attitudes and behaviour (see Franssonn and Garling, 1999; Bamberg, 2003); the latter since a substantial volume of literature has concluded that the decision-making processes of consumers with extensive product knowledge differ

substantially from those of individuals with little product knowledge (see Brucks, 1985; Park and Moon, 2003; Tsai, Chang and Ho, 2015).

Environmental concern

Environmental concern has been defined as the self-evaluation of facts and of one's own and other people's attitudes and behaviour in relation to the environment (Franssonn and Garling, 1999). It has been found to depend significantly on a person's environmental values (Bamburg, 2003) and to have a heavy impact on environmentally-related intentions (Franssonn and Garling, 1999; Sexton and Sexton, 2014). Environmental concern is said to be rooted in a person's self-concept (Schultz and Zelenzny, 2000) and, according to Bamburg (2003), to reflect general values and beliefs that trigger attitudes regarding specific environmentally-friendly products. Empirical studies of the possible connection between environmental concern and attitudes to 'green' products have typically concluded that there exists a growing awareness among many consumers of the harm being done to the environment and hence that green products are beneficial (see Khaola, Potiane and Mokheti, 2014 for information on relevant investigations). Research has established moreover that high environmental concern can motivate the search for knowledge about environmentally-friendly products (Minton and Rose, 1997; Hansla, Gamble, Juliusson and Garling, 2008). Environmentally concerned individuals may *want* to learn more about environmentally-friendly products (hence triggering a search for information, see Laroche, Bergoron and Babaro-Forleo [2001]), and the more they learn the more likely that their attitudes regarding such products will be positive (Albayrak, Aksoy and Caber, 2013). The cognitive effort devoted to information search may be substantial, and much attention might be paid to the environmental aspects of specific products (Franssonn and Garling, 1999).

Hence:

Hypothesis 4. High environmental concern causes (a) greater EV product knowledge, and (b) favourable attitudes towards EVs.

Prior knowledge of EVs

Prior knowledge of a product category has been identified in research literature as a critical source of individual differences in purchasing behaviour (Cheron and Hayashi, 2001). Such knowledge derives in part from the number and depth of a person's product related experiences. It can also involve subjective elements (sometimes arising from social norms [Moons and De Pelsmacker, 2012; Rezvani, Jansson and Bodin, 2015), not based on objective experience or facts. Regardless of its source, product knowledge is known to be an important factor in consumer attitudes to EVs (Egbue and Long, 2012; Rezvani et al., 2015) that influences the ways in which individuals organise, interpret and explain their thoughts about the product (cf. Alba, 1983). Product knowledge, moreover, 'facilitates the acquisition of completely new information about the product and increases search efficiency' (Brucks, 1985 p.1); can result in the application of greater discrimination and more intense focus when evaluating the product; and may influence expectations of product performance, characteristics, and level of satisfaction anticipated from using the product (Soderlund and Gunnarsson, 2000). This in turn is likely to affect attitudes towards the product (Tsai, Chang and Ho, 2015) and a person's feelings of self-confidence when considering a product purchase (Park and Lessig, 1981; Park and Moon, 2003). Consumer knowledge of EVs may

arise from an individual's exposure to advertisements in television programmes, from newspaper or magazine articles, from conversations with other people, or from 'mere exposure' (Le Hebel, Montpied and Fontanieu, 2014). It could involve the receipt of information on the ease of use of an EV, battery life, costs or other aspects of EVs, and might be primed by earlier contacts with EV information sources.

Accordingly:

Hypothesis 5. A high degree of product knowledge of EVs causes favourable attitudes towards EVs.

Further possible influences of product knowledge and environmental concern

Although past research has not addressed the possibility that environmental concern and product knowledge could affect product user SIC and/or the stereotype of a product's users, it is plausible to suppose that both these variables may influence the nature of a person's stereotype of EV owners and the individual's EV-related product user SIC. Product knowledge could impact product user SIC via a person's familiarity with the functional aspects of EVs (their utility, efficiency, performance features, etc., cf. Sirgy et al. [1991]) thus improving the match between the product and an individual's expectations of its value, both to the person in question and to his or her friends, relatives, work colleagues and so on. An individual's self-image as someone who might buy an EV could therefore be greater if the individual knows a lot about the benefits of owning the product. Likewise, EV product knowledge might influence the cognitive processes that help determine perceptions of the stereotype of EV owners (Soderlund and Gunnarsson, 2000), given that people who are knowledgeable about EVs may understand their qualities and capacities more deeply (Brucks, 1985) and hence might rely on this knowledge to form judgements using a higher level of discrimination (Soderlund and Gunnarsson, 2000) about the characteristics of EV drivers (cf. Park and Lessig, 1981). Hilton and von Hippel (1996) observed how stereotype formation depended critically on 'previously stored knowledge about the attributes associated with a particular group' (p. 261).

Environmental concern might affect the formation of a stereotype of EV drivers because, according to Brough and Wilkie (2016), environmental concern is 'stereotypically associated' with certain characteristics assumed to apply to a stereotyped category of consumers of environmentally-friendly products (p. 1), and since environmental concern allegedly begets a search for knowledge about an environmentally-friendly product (see above) thus influencing stereotype formation. High environmental concern could affect product user SIC through (i) enhancing the match between a person's interest in environmental matters and how the individual sees him or herself as someone who actively engages in environmentally-friendly behaviour (Franssonn and Garling, 1999; Sexton and Sexton, 2014), and (ii) helping the person create, preserve and maintain a self-identity as the sort of individual who relates to others who use environmentally-friendly products (Albayrak et al., 2013; Brough and Wilkie, 2016).

Thus, it is proposed that:

Hypothesis 6. Environmental concern causes (a) high product user SIC in relation to EVs, and (b) a less unfavourable stereotype of EV owners.

Hypothesis 7. Product knowledge causes (a) high product user SIC in relation to EVs, and (b) a less unfavourable stereotype of EV owners.

The model was estimated both before and after a participant had played the game. As playing the game might add to a person's knowledge of EVs (cf. Sailer et al., 2013; Freudmann and Bakamitsos, 2014; Landers et al., 2015) and also might focus his or her attention on environmental issues (Fransson and Garling, 1999; Hansla et al., 2008) it is further posited that:

Hypothesis 8. Playing the game causes (a) high product knowledge in relation to EVs, and (b) a high level of environmental concern.

Attitude and willingness to purchase

Intuitively, favourable attitudes towards a product should be associated with greater inclinations to purchase the product (Peter and Olsson, 2008), although attempts to demonstrate the presumed link between attitude and willingness to purchase have often been unsuccessful, especially in relation to environmental attitudes and actual environmental behaviour (for reviews of studies concerning this matter see for example Hini et al. [1995]; Grewal et al. [2000], Khaola et al. [2014]). Hini et al. (1995) noted the complexity of the attitude-willingness to purchase relationship and hence the many problems of measurement surrounding its estimation; given the large number of situational and personality factors that potentially affect a buying decision, e.g., variations in attitudes towards risk, the influences of marketing and advertising, prices of alternatives, and differences in the levels of importance that consumers attach to specific variables. Thus, the strength of the assumed link is likely to vary according to several considerations. Johnstone and Hooper (2016), for instance, pointed to (lack of) peer pressure, dearth of information on product performance, and limited availability of the product as possible confounding factors. Affordability of a product is a major determinant of willingness to buy the product so it is necessary to take this into account when questioning consumers regarding this issue (Dodds, Monroe and Grewal, (1991).

The present study examined the possibility that product user SIC and the degree of negativity of a person's stereotype of EV owners moderate the connection. Product user SIC is proposed as a moderator because a heavy personal identification with people who drive EVs could stimulate willingness to purchase to a level over and above that arising from the effect of a person's favourable attitude regarding the objective qualities of EVs. Negativity of stereotype is suggested as a moderator because a poor image of EV owners might weaken willingness to purchase on the grounds that an individual holding such a stereotype might not wish to be associated with the presumed characteristics of the stereotyped group (cf. Grewal et al., 2000), even if the person's attitude concerning the properties of EVs is not entirely unfavourable.

Hypothesis 9. Favourable attitudes towards EVs cause willingness to purchase an EV.

Hypothesis 10. The strength of the connection between attitude and willingness to purchase is moderated (a) positively by high product user SIC, and (b) negatively by an individual's possession of a negative stereotype of EV owners.

Figure 1 portrays diagrammatically the hypotheses concerning the determination of attitude towards EVs. It also shows the suggested moderating influences of SIC and stereotyping on the attitude to willingness to purchase link. The variables explaining attitude were entered into a structural equation model while the moderation of the connection between attitude and willingness to purchase was estimated separately using specialist moderation analysis software.

INSERT FIGURE 1 HERE

Methodology

The strengths of the study participants' presumed stereotype of EV drivers were assessed both before and after an individual had played the game using an Implicit Association Test (IAT) (Greenwald, McGhee and Schwartz, 1998). IATs measure implicit as well as explicit biases in stereotypes by evaluating the strengths of connections between automatically made associations (e.g., 'EV Owner and unconventional type of person' or 'non-EV owner and conventional type of person'). This is achieved by presenting people with words on a computer screen that are potentially associated with a presumed stereotype and asking the participants to place these words into categories (e.g., by pressing the plus or minus keys on a computer keyboard). Strength of association is measured by performance speed and accuracy as the respondent completes classification tasks: the faster the speed the stronger the assumed association. As an IAT requires instant judgements, participants cannot analyse information before responding, hence avoiding social responsibility bias, yet revealing potentially hidden prejudices (Greenwald and Banaji, 1995; Devine, 2001). Also, IATs allegedly avoid in large part the problem that self-reported paper based measures depend on subjects' willingness to report their *true* beliefs (Greenwald et al., 2002). The configuration of the IAT used in the present study (set up using cognilab software) is given in Table 1.

INSERT TABLE 1 HERE

This IAT pre-assumes that non-EV drivers might regard EV owners as 'unconventional' individuals who possess traits such as being eccentric, political, bohemian, etc. (see section C of Table 1) when compared to 'conventional' drivers of petrol driven vehicles, who are assumed to be moderate (as opposed to radical), mainstream, and so on (see section D). At the beginning of the IAT the participant was confronted with two divisions (EV owners and Petrol vehicle owners) appearing at opposite ends of a computer screen. The person then categorised displayed examples of EVs and conventional vehicle models (Table 1 sections A and B) into one or other of the divisions. (IATs employ this initial procedure to focus the participant's thoughts on the two alternative kinds of entity.) Two possible descriptors of each division (unconventional and conventional) then replaced the original divisions at each top corner of the computer screen and the individual categorised various words (Table 1 sections C and D) into either of the divisions. Next, two combinations of the above ('EV owners or conventional' and 'Petrol vehicle owners or unconventional) replaced the previous divisions, into which the person placed various words. The positions (left or right) of the divisions in the abovementioned steps were then reversed, and so on. (Many free of charge examples of IATs and their method of construction are available online via the major Internet search engines.)

Following Greenwald, McGhee and Schwartz (1998), the words listed in sections C and D of the IAT shown in Table 1 were derived from a review of academic and practitioner literature describing possible negative stereotypes of EV owners (see above) and were compared with words obtained from a previous study (Bennett et al., 2016) that asked 221 people to state the first thing that came to mind when thinking about EV owners. Words common to both sources were identified and grouped thematically under the headings shown in Table 1.

Environmental concern was measured via six items adapted from Franssonn and Garling (1999) and Le Hebel, Montpied and Fontanieu (2014). Participants' responses (seven-point agree/disagree

scales) were factor analysed, a unidimensional solution emerging (Lambda=4.2; Alpha=.91). Knowledge of EVs was assessed through four items based on Park and Lessig (1981) (Lambda=3.2, Alpha=.88). Attitude towards EVs was evaluated by five items adapted from Ajzen (2006) (Lambda=3.7, Alpha=.89); willingness to purchase (in the context of an EV's affordability given the consumer's budget) by four items based on Thiel et al. (2012) and Dodds et al. (1991) (Lambda=3.0, Alpha=.9). The items in each of these unidimensional solutions were composited (by averaging) for use in subsequent analysis. Each of the four components of product user SIC identified by Sirgy et al. (1992) (actual, ideal, social and ideal social) was measured through five items adapted from Sirgy and Johar (1999) and, following Sirgy and Johar (1999), the scores from the responses to the four components were summed to create an overall formative index of the strength of a person's product user SIC with respect to EVs.

Data collection

As the study required participants to spend considerably more time on completing questionnaires than is normally the case in survey research, a commercial data collection agency (Lightspeed) was employed to obtain responses from a consumer panel drawn from across the United Kingdom. (The UK as a whole was selected for the agency sampling frame because rates of EV ownership [measured in terms of EV charging point usage] are broadly similar in each of the four countries within the UK [Zap-Map, 2017].) Although the use of a consumer panel meant that the respondents were obtained from the agency's database of people willing to participate in surveys, the panel from which the participants were obtained comprised many thousands of individuals who had been pre-screened for response honesty, and for whom the agency possessed substantial demographic information. Thus, the agency could ensure that respondents fitted appropriate selection criteria (e.g., drivers, equal numbers of males and females, age over 18, a balance of high, medium and low income individuals). The agency has statistical procedures for detecting response bias ('yea saying' for instance), for filtering non-credible responses, and for ensuring that sample members (selected via a randomisation process) represent a broad cross-section of the relevant population. Respondents were given a participants' discount voucher. The agency employs Question/Arts software in order to make surveys accessible across mobile as well as personal computer devices and has facilities for administering complex web-related questionnaires. Participants first completed a questionnaire (see the Appendix) that asked about their personal characteristics and driving habits, level of environmental concern, prior familiarity with EVs, self-image congruence with owners of EVs, attitude towards EVs, and willingness to purchase. The questionnaire was administered only to people who had not owned or driven an EV. Sections 4 and 6 of the Appendix assessed whether a respondent was likely to feel involved with the product. A day or two later the person played the EV game (this delay being necessary to avoid cognitive overload) and after another day or two repeated the IAT and questionnaire items concerning attitude to EVs, self-image congruence, etc. Respondents completed the IAT online and played the game either online or by downloading an app. The data collection agency obtained 350 responses to which were added 152 responses, gathered by the researchers and a research assistant from university employees and workers in businesses around the home university of one of the authors. Fifty-six per cent of the sample was male, with a median age of 40 years (39 for females). The participants were relatively evenly divided in terms of education and income level. Eighty-five per cent of the participants were in employment (68% working in non-manual occupations). There were no significant disparities in the response patterns of the subjects tested by the agency and those dealt with by the researchers.

Results

The results did not vary significantly with respect to respondent demographics or number of miles driven. Composite reliabilities for environmental concern, product knowledge and attitude exceeded .73 (product user SIC was measured as a formative construct); all the average variance extracted figures were greater than .58, and the Fornell-Larcker (1981) criterion for discriminant validity (i.e., that AVEs had higher values than the R-squares among the constructs) was

satisfied. Variance inflation factors for all the independent variables were less than eight, indicating the absence of technical problems associated with multicollinearity. Consequent to the participants playing the game the mean value of the attitude towards EVs measure increased by an average of 17% (z=3.7, p<.001), the stereotype of EV owners moved in the positive direction by an average of 19% (z=4.6, p<.000), while product user SIC increased on average by 14% (z=3.0, p<.001). However, willingness to purchase was largely unaffected, rising by just 1.9% (z=.06, p=.65). Product knowledge rose by an average of eight per cent (z=2.22, p=.03); while environmental concern increased by just 2.7% on the average (z=.09, p=.37). Thus, hypotheses 2(a), 2(b) and 2 (c) and hypothesis 8(a) are supported; hypothesis 2(d) and hypothesis 8(b) are rejected.

Table 2 gives the parameter estimates (unstandardized coefficients were computed in order to apply Sobel's z test for the significance of mediating influences [Sobel, 1982]) emerging from the estimation of the model relating to the determination of attitude (using the bootstrapping facility of the AMOS 22.0 package) before and after the participants had played the game and when they had completed the two (before and after) questionnaires. (The estimation of the attitude-willingness to purchase link is considered separately in a later section.)

INSERT TABLE 2 HERE

The model provided a good fit to the data in both the pre- and post-game situations (for the former case CFI=.98; GFI=.94; TLI=.91; RMSEA=.04; Chi-square/df=.58 and, for the latter, CFI=.99, GFI=.97; TLI=.96; RMSEA=.04; Chi-square/df=.51). It can be seen from Table 2 that, prior to playing the game, the participants' responses suggest that product knowledge of EVs exerted very little influence on attitude (b=.07, p=.39) (H5) or on product user SIC or on the negativity of the participants' stereotype of EV owners (H7b). Also, there was no significant connection between environmental concern and product knowledge (b=.08, p=.24) (H4a). People who were high in concern for the environment seemingly did not on the average translate this concern into a search for information about EVs. All other pathways in the model attained statistical significance: both product user SIC and the negativity of the participants' stereotype of EV owners impacted strongly on attitude towards EVs.

As Figure 1 illustrates, environmental concern and product knowledge exert both direct effects on attitude (H4b and H5) and indirect effects via product user SIC (H6a, H7a and H1b) and stereotype (H6b, H7b and H3). To test the significance of the mediated indirect pathways, bootstrapped standard errors were calculated using the AMOS package and employed in Sobel tests of the significance of the mediated pathways. (The Sobel test assesses the combined significance of the pair of coefficients within each mediating pathway - see Preacher and Hayes [2004] for details of mediation tests within structural equation models].) The indirect mediating effect of product user SIC on the influence of environmental concern on attitude was significant (Sobel's z=2.51, p=.01), likewise for the pathway emanating from environmental concern and involving stereotype negativity (Sobel's z=2.84, p=.002). The indirect mediating effect of environmental concern on attitude passing through both product user SIC and stereotype negativity exhibited significant coefficients (p<.000) on all three sub-components (b=.29, b=.6 and b=-.45). Neither of the mediating pathways associated with product knowledge attained significance (Sobel's z=.98, p=.33 for the stereotype negativity pathway and Sobel's z=1.52, p=.13 for the product user pathway).

Re-estimation of the model consequent to the participants playing the game revealed that, while the hypothesised connection between environmental concern and product knowledge remained insignificant (b=.10, p=.36), product knowledge of EVs now exerted a significant direct influence on attitude (b=.25, p=.02) and significant indirect effects via product user SIC (Sobel's z=2.38,

p=.02) and through stereotype negativity (Sobel's z=2.2, p=.03). Thus hypothesis 4 (a) is rejected. Hypothesis 5 is supported only in the post-game situation, as are hypotheses 7 (a) and (b). Environmental concern continued to constitute a key aspect of the model; its direct impact on attitude increased to b=.76 (from b=.6 in the pre-game situation), hence confirming hypothesis 4 (b), and its indirect effects through product user SIC and stereotype negativity were highly significant (Sobel's z=2.93, p=.003 in both cases). All three of the pathways from environmental concern to attitude via product user SIC and stereotype negativity were significant (p<.000). The direct effects of environmental concern on product user SIC and stereotype negativity were highly significant (p<.000), substantiating hypotheses 6 (a) and (b). Table 2 shows that hypotheses 1 (a) and (b) and hypothesis 3 are accepted in respect of both the pre- and post-game scenarios.

To analyse the connection between attitude and willingness to purchase (H9) the data for these variables was entered into Hayes' (2013) PROCESS analysis macro for SPSS (Hayes Model 2) together with data for the two hypothesised moderators (product user SIC and stereotype negativity) (H10 [a] and [b]). The Hayes (2013) macro generates robust bias corrected bootstrapped 95% confidence intervals for selected values of specified moderators. A moderating effect is deemed statistically significant if its lower confidence interval does not include zero. Three values of each moderator were employed: high, medium and low, defined as the mean value of a moderator plus and minus one standard deviation from the mean. The main effect of attitude on willingness to purchase was weak in both the pre- and post-game situations (b=.1, p=.15 and b=.12, p=.1 respectively). Thus hypothesis 9 cannot be accepted. However, the connection was strengthened considerably when the influences of the moderators were taken into account, as shown in Table 3.

INSERT TABLE 3 HERE

Both of the moderators were significant at their average values at the 95% level both before and after the participants had played the game. The lower confidence intervals of all the coefficients (pre- and post-game) for high and low stipulated values of the moderators were above zero, indicating significant differences from zero. Hence hypotheses 10 (a) and (b) are supported. It can be seen from Table 3 that high values of the moderators exerted greater influences on the strength of the attitude-willingness to purchase connection than did low values, suggesting that modest levels of product user SIC and stereotype negativity were associated with some degree of indifference towards EV purchase whereas high values of these variables sharpened substantially a person's willingness to buy an EV. Nevertheless, all levels of each of the moderators exerted significant impacts (p=.05), underpinning their importance vis-à-vis potential EV purchasing decisions.

Conclusion

This study developed an integrated model of potential determinants of consumer attitude toward electric vehicles based on the posited influences of a specific stereotype of EV owners possibly held by people without experience of EVs, and on the latter's self-image congruence concerning EV ownership. Environmental concern and EV product knowledge were suggested as antecedents of both product user SIC and stereotype negativity as well as exerting direct effects on consumer attitude. Interrelations among the variables were examined, as was the relationship between attitude and willingness to purchase. The model was estimated before and after study participants had played a game in which they assumed the role of an EV driver. It emerged that the participants' attitude regarding EVs, their product user SIC regarding EVs, and the favourability of their stereotype of EV owners increased significantly and substantially

consequent to their having played the game, substantiating the view that gamification has a positive utility for securing favourable attitude change in respect of such matters (cf. Lee and Hammer, 2011; Sailer et al., 2013; Bittner and Shipper, 2014; Burke, 2014). Also, the respondents reported significant increases in their product knowledge of EVs after playing the game, suggesting that the experience caused them to learn about the product (Hamari et al., 2014; Huber and Hilty, 2014; Landers et al., 2015). Clearly the participants felt they had learned a great deal about EVs through playing the game. Moreover, product knowledge exerted a significant influence on attitude in the post-game situation (cf. Tsai et al., 2015), again underscoring the value of gamification. The results show significant links between the negative stereotyping of EV owners and attitude towards EVs (cf. Greenwald and Banaji, 1995; Wittenbrink et al., 2001; Forbes and Schader, 2010), and between product user SIC and (i) attitude towards the product (cf. Jamal and Goode, 2001; Farhat and Khan, 2012, see also Claiborne and Sirgy's [1990] review of 30 early studies relating to the issue)) and (ii) the stereotyped user image of EV owners (cf. Sirgy et al., 1992, Kressmann et al., 2006). The direct effects of product user SIC and stereotype negativity on attitude were substantially stronger in the post-game scenario. The findings also indicate that stereotype negativity was substantially reduced as a result of the participants playing the game. This confirms the view that stereotypes and attitudes can be changed via the provision of relevant cues (Brendl et al., 2001; Hamilton et al., 2015), and by activity that arouses empathy within the users of a product (cf. Sailer et al., 2013; Huber and Hilty, 2014). Several research studies reported by Greenwald et al. (2002) found that 'exposure to admirable exemplars of stigmatised categories reduced implicit negativity toward these categories' (p. 9).

Environmental concern emerged as a major influence on product user SIC (H6a), stereotype negativity (H6b) and attitude H4b). The last of these findings is in line with those of Bamburg (2003) and others (see Khaola et al. [2014] for details), although environmental concern was not significantly associated with EV product knowledge. It seems that high levels of environmental concern among the members of the sample who possessed this characteristic had not motivated a desire to acquire knowledge about EVs. Past research has established positive and significant connections between environmental concern and the search for product knowledge (e.g., Laroshe et al., 2001; Hansla et al., 2008), but the link was not evident in the present study. Environmentally concerned individuals apparently did not believe that EVs are products about which they should seek detailed information. An explanation for this might relate to failures of marketing communications on the part of EV manufacturers and government agencies tasked with promoting EVs (Bennett et al., 2016). A further possibility is that the weak connection is, in the words of Bamburg (2003) 'due to the incorrect assumption that general attitudes like environmental concern are *direct* determinants of specific behaviours' such as search for product knowledge (p.21), suggesting that the relationship is multi-faceted and complex. Bamburg's (2003) own study of environmentally concerned people found that a high level of concern failed to predict whether an individual would request an information brochure about a green product.

In line with the conclusions of past research (e.g., Hini et al., 1995; Grewal et al., 2000; Khaola et al., 2014; Hassan et al., 2016), the present study found only a weak link to exist between attitude towards EVs and intention to purchase EVs. Caruana, Carrington and Chatzidakis (2016) cited studies which found that while around 30% of consumers profess concern for the environment, barely five per cent ever translate this concern into purchases. In the present context, it could be that a change in willingness to buy the product results mainly from events, views and judgements that develop over a considerable period of time, and as such may not be easy to modify through playing a game. A consumer's perceptions of EVs is likely to contain both positive and negative elements arising from a number of product-related mental associations. This might create 'subjective ambivalence', i.e., aversive feelings that discourage willingness to purchase (Suki, 2016). However, the connection was significantly stronger among participants high in product user SIC vis-à-vis EVs and low in stereotype negativity. This confirms perhaps the complexity

and multi-dimensional nature of relationships between attitudes relating to environmentally-friendly products and willingness to buy them (Hini et al., 1995; Hassan et al., 2016; Johnstone and Hooper, 2016). It is also compatible with the observation of Puntoni (2001) that self-image influences willingness to purchase indirectly 'through the behavioural beliefs related to the schemata with which self-identity has been defined' (p.130).

Contributions to theory

The outcomes to the current research advance knowledge in a number of ways. Theories of gamification predict that game playing facilitates rapid learning (see the meta-analysis of Wu, Hsiao, Wu, Lin and Huang, 2011; see also Freudmann and Bakamitson, 2014; Hamari et al., 2014) although, according to Seaborn and Fels (2015), empirical results pertaining to this have been mixed. The results of the present study are compatible with the notion that individuals can quickly absorb knowledge when playing a game. These outcomes also help confirm the proposition (see McGonigal, 2011) that a game does *not* need to involve 'playfulness' in order to motivate and engage consumers in non-entertainment contexts. Blohm and Leimeister (2013) noted how a game that represents reality can induce motives of curiosity and exploration that bring about attitude change. As regards theories of stereotyping, the outcomes to the investigation are in line with the assertions of the theory of cognitive dual processing (Devine, 1989) which proposes that automatic activations of stereotypes may be followed by a controlled processing stage (in the present case playing the game) during which a person might choose to disregard the stereotyped information initially brought to mind. Thus, prior stereotyped interpretations might be substantially eliminated, hence facilitating stereotype change (as observed by Brendl et al, 2001; Dasgupta and Greenwald, 2001; Hamilton et al., 2015). In relation to product SIC, most research has focused on the consequences of SIC rather than its causes (e.g., Heath and Scott, 1998; Jamal and Goode, 2001; Kressmann et al., 2006; Hosany and Martin, 2012). However, in the words of Onkvisit and Shaw (1987), the process of the *formation* of SIC is critically important for 'understanding a consumer's behaviour and relationship with his or her objective, subjective, social and ideal self' as it affects product choice (p.13). The results are in harmony with SIC theories which posit that product SIC can be affected by personal traits (environmental concern and product knowledge in the present context).

Methodological contributions

Rezvani et al. (2015), in noting that most EV attitude research has involved questionnaire surveys unrelated to a consumer's actual experience of electric vehicles, called for alternative and more innovative methodological approaches to the assessment of EV attitudes. Gamification researchers too have called for stronger experimental designs (Seaborn and Fels, 2015; Wu et al., 2015). The present research contributed to these requests via a research design that combined a structural equation model with a before-and-after game-based IAT attitude assessment methodology not previously employed within EV investigations. A representative sample of UK non-owners of EVs was brought into close personal contact with EVs and was drawn into a psychological relationship with EV driving performance. Accordingly, the study was conducted in a realistic context yet one providing a means for measuring the strengths of connections among variables with minimum social responsibility bias. Additionally, the research examined the link between attitude and willingness-to-purchase EVs in a detailed and rigorous manner.

Practical implications

The results have several implications for the marketing of EVs both by EV manufacturers and by state agencies. Gamification seemingly represented a powerful instrument for achieving attitude, stereotype, product knowledge and attitude change. Applying gamification to the stimulation of

the mass market for EVs is therefore to be recommended, as are measures to improve the public stereotype of EV drivers. It is relevant to note in this connection that in 2013 the UK the government established a dedicated Department of State to oversee low emission vehicle initiatives (OLEV, 2013), and additionally subsidised private manufacturers to the extent of £2.5 million to launch an advertising campaign to educate the general public about EVs. Games featuring EVs (which need to be relevant for consumers and designed to increase their intrinsic motivation to learn more about EVs [Wu et al., 2011]) can be disseminated to the driving public on-line (e.g., by offering a free download of an EV game to people entering a generic car sale website or a manufacturer's promotional website) or through car dealer outlets (given that a game can represent a virtual test drive). Links to a game can be provided in social media advertisements and might be accompanied by quizzes about EVs and EV driving cost calculators. So far as general advertising of EVs is concerned, the powerful influence of product user SIC revealed by the study indicates the need to include emotional elements in advertisements as well as functional information about battery life, top speed, etc. Relevant emotions might involve 'feeling good' about caring for the environment, pride in being a technological leader, or being associated with a high-status group.

Product knowledge only exerted significant influences in the post-game scenario. Improvements in EV product knowledge in general might be stimulated through (i) marketing communications that feature the functional aspects of electric vehicles as well as their aesthetic qualities, and (ii) measures to bring members of the public closer to EVs. The latter may be achieved via 'pop-up' EV information centres in shopping malls (as has been practised in Denmark and Germany (see www.nsr.eu/events) and through attention-attracting mobile information centres that park in city streets. The significance of product user SIC as a determinant of both attitude and stereotype formation suggests the desirability of EV manufacturers and state agencies demonstrating in their marketing communications that *attractive* people (e.g., show business celebrities and/or leading sports personalities) regard themselves as the types of individual who want to drive EVs. Senior politicians could set an example by being seen to use EVs when undertaking ministerial duties. Celebrity endorsements of various EV brands could help achieve this objective. Similar recommendations apply to the finding that attitude towards EVs was significantly affected by stereotype negativity. The stereotype of EV owners might be greatly improved by marketing communications that show a wide range of influential and attractive groups of people driving EVs, thus obviating (hopefully destroying) all vestiges of a 'tree-hugger' image. As product user SIC vis-à-vis improves, and as the stereotype of EV owners becomes more favourable, the connection between attitude and willingness to purchase EVs should strengthen. Achievement of an improved public stereotype of EV owners will be facilitated if the mass media begins to support EV purchase. Encouraging the media to do this will require carefully crafted public relations press releases (prepared by manufacturers and government EV support agencies) with stories that portray EV drivers in a positive light.

Environmental concern significantly affected all elements of the model apart from product knowledge. The stimulation of concern for the environment is a matter for national and regional governments as a component of wider ranging citizenship campaigns, stressing the environmentally-friendly nature of electric vehicles. Symbols of environmental concern (e.g., having a green registration number plate or a prominent window screen sticker) could be issued to owners of low emission vehicles.

Limitations and suggestions for future research

The study was completed in a single country where EVs are not well-established, implying the desirability of replicating the investigation elsewhere. Due to the need to restrict the size of the model to estimable dimensions the research considered just two covariates: environmental

concern and product knowledge. It would be useful to examine the influences of other covariates that potentially might affect product user SIC and stereotype negativity, e.g., susceptibility to influence, affect intensity and/or other emotional tendency variables. Rezvani et al. (2015) noted that research employing self-efficacy as a determinant of willingness to purchase EVs (e.g., Oliver and Rosen, 2010) has yielded positive results, so it would be interesting to include this characteristic in a larger structural equation model. An extended model could incorporate mediators and moderators helping to explain more fully the link between environmental concern and attitude (cf. White and Sintov, 2017). Another issue is the fact that any IAT presupposes the existence of a specific form of stereotype and tests participants' views against this pre-specified benchmark. A range of alternative stereotypes is available, and it would be valuable to repeat the study using different presumed stereotypes (e.g., trend setting, innovative, intelligent, socially-responsible). Also, different IATs could be set up for disparate types and styles of EV (e.g., mundane and utilitarian, luxurious, small or large) and differing price bands. IATs comparing responses for purely electric vehicles with hybrids would be valuable.

The game used in the present study involved an urban journey with roadworks and frequent left and right turns through city streets. Games featuring journeys on motorways and in rural locations could be constructed to generalise the findings of the current investigation. Given that past research has found that experience of EVs improves consumer attitudes to EVs (though not actual purchase) (see Schmalfuss, Muhl and Krems, 2017) the application of a virtual reality game to the assessment of attitude change would be valuable, as the player's sense of experiencing the product would be enhanced. The impact of the game on an individual might be affected by the person's learning style (Wu et al., 2011), so this also might be included in future studies. Finally, it is clear that more research into the characteristics of the link between attitudes to EVs and willingness to purchase such vehicles needs to be undertaken, introducing several possible mediating and moderating influences. The present study examined connections between attitude and willingness to purchase among potential EV buyers. However, 'willingness' to buy does not necessarily lead to an *actual* purchase. It is increasingly recognised that connections between purchase intention and buying behaviour for environmentally-friendly products are complex and require detailed modelling (see Hassan et al. [2016] for details of literature supporting this proposition). Separate studies may be needed to analyse this relationship comprehensively in the EV context.

APPENDIX. THE QUESTIONNAIRE

1. *Personal characteristics*: gender, age and income categories; household structure; types of journey undertaken; highest educational qualification. (Items based on Choo and Mokhtarian, 2004.)

2. *Environmental concern*

   (a) People worry too much about human progress harming the environment.
   (b) It is just too difficult for someone like me to do much about the environment.
   (c) I am a person who does what is right for the environment, even when it takes more time or costs more money.
   (d) I am willing to pay higher taxes in order to protect the environment.
   (e) We cannot rely on modern technology to solve environmental problems.
   (f) Threats to the environment are not my business.

3. *EV product knowledge*

(a) I have little knowledge of electric vehicles.
(b) I have little experience of electric vehicles.
(c) I am not familiar with electric vehicles.
(d) I am largely ignorant of EVs.

4. *Attitude towards electric vehicles*

(a) I believe that electric vehicles are: (i) a good thing, (ii) beneficial (iii) attractive.
(b) Government support for the widespread use of electric vehicles is wise.
(c) My attitude towards electric vehicles is favourable.

5. *Willingness to purchase*

Provided the price of an EV (taking into account of the £5000 price reduction due to the government subsidy) was reasonable and within my budget:

(a) I would be very willing to buy an EV.
(b) I would seriously consider buying an EV.
(c) I would be enthusiastic about the prospect of buying an EV.
(d) I would consider it important to think carefully about buying an EV.

6. *Self-image congruence with owners of EVs*

Actual

(a) The image of people who own electric cars is highly consistent with how I see myself.
(b) I find it hard to relate to people who drive electric cars.
(c) I cannot relate to people who prefer to own electric cars rather than petrol or diesel vehicles.
(d) People who are very different to me prefer to own electric cars.
(e) I am very much like the typical person who prefers electric cars to petrol or diesel vehicles.

Ideal

(a) I would probably like myself better if I were to drive an electric car.
(b) Owning an electric car would make me feel special.
(c) I like the image of people who own electric cars.
(d) I would not think highly of myself if I were to own an electric car.
(e) I really like the kind of person who drives an electric car.

Social

(a) People who are close to me would have a hard time thinking of me as someone who owns an electric car.
(b) People who know me well think I am very different to the sorts of individuals who drive electric cars.

(c) My relatives and friends usually view me as being like the typical person who prefers an electric car to a petrol or diesel vehicle.
(d) The image of owners of electric cars is highly consistent with how I am seen by people who are close to me.
(e) People who know me think of me as someone who would be happy to buy an electric car.

Ideal social

(a) People I associate with do not have much regard for the image of owners of electric cars.
(b) My friends and relatives do not like to see me as someone who drives an electric car.
(c) People would think better of me if I owned an electric car.
(d) My friends and relatives would like me more if I drove an electric car.
(e) My friends and relatives like the image of people who own electric cars.

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TABLE 1. THE IAT

A. EV Owners: VW Golf Electric; Ford Focus Electric; Audi Q8 Electric; BMWi3 Electric; Renault Zoe Electric.

B. Petrol Vehicle Owners: Nissan SUV Petrol; Vauxhall Corsa Petrol; Citroen C1 Petrol; Volvo SUV Petrol; Mercedes C-Class Petrol.

C. Unconventional: Offbeat; Radical; Opinionated; Political; Eccentric; Bohemian; Unconventional.

D. Conventional: Moderate; Orthodox; Mainstream; Normal; Traditional; Standard; Conventional.

TABLE 2. PARAMETER ESTIMATES

RESULTS OF HYPOTHESIS TESTS	PATHWAY	PRE-GAME	POST-GAME
H1a Accepted	Product user SIC -> Negative stereotype	.60 (5.22)	.62 (5.5)
H1b Accepted	Product user SIC -> Attitude	.66 (4.66)	.75 (6.4)
H3 Accepted	Negative stereotype -> Attitude	-.45 (4.48)	-.68 (5.56)
H4a Rejected	Environmental concern -> Product knowledge	.08 (1.1)	.10 (1.01)
H4b Accepted	Environmental concern -> Attitude	.60 (5.22)	.76 (6.8)
H5 Accepted only post-game	Product knowledge -> Attitude	.07 (.09)	.25 (2.30)
H6a Accepted	Environmental concern -> Product user SIC	.29 (2.99)	.40 (3.34)
H6b Accepted	Environmental concern -> Negative stereotype	-.39 (3.03)	-.41 (5.00)
H7a Accepted only post-game	Product knowledge -> Product user SIC	.19 (1.61)	.21 (2.30)
H7b Accepted only post-game	Product knowledge -> Negative stereotype	-.05 (1.0)	-.25 (2.63)

Unstandardized coefficients. Critical ratios in parentheses

TABLE 3. MODERATING EFFECTS ON THE ATTITUDE-WILLINGNESS TO PURCHASE LINK

Product User SIC Moderator: Pre-game situation	Coefficient	Bootstrap standard error	Lower 95% confidence interval	Upper 95% confidence interval
High	.11	.035	.042	.178
Medium (mean value of moderator)	.08	.027	.027	.133
Low	.05	.02	.011	.089
Negativity of Stereotype Moderator: Pre-game situation				
High	.07	.026	.019	.121
Medium (mean value of moderator)	.05	.014	.023	.077
Low	.03	.011	.009	.051
Product User SIC Moderator: Post-game situation				
High	.11	.036	.04	.18
Medium (mean value of moderator)	.09	.038	.016	.164
Low	.06	.021	.019	.101
Negativity of Stereotype Moderator: Post-game situation				
High	.07	.023	.025	.115
Medium (mean value of moderator)	.04	.013	.015	.065
Low	.03	.013	.005	.055

FIGURE 1. CONCEPTUAL MODEL