Driverless Futures: Current Non-drivers' Willingness to Travel in Driverless Vehicles

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Abstract

This study examines the willingness of a sample of 526 current UK non-drivers to travel in driverless vehicles (DVs). Road traffic is predicted to increase between 10%-40% consequent to current non-drivers taking to the road; the new market including individuals who are unable or unwilling to drive: the aged, people with physical and/or mental impairments, and those who possess phobias about driving. Behavioural Reasoning Theory is employed to explore explicit and implicit attitudes of non-drivers towards DVs. Implicit attitudes towards this 'really new' product are measured via an Affect Misattribution Procedure (AMP). Sample members completed an online questionnaire containing the AMP plus items on reasons for and against DVs, beliefs and values concerning new technologies, and covariates suggested by literature in the transport marketing field. Findings from the study suggest that different types of message will be required to promote DVs to various groups of non-drivers, e.g., those exhibiting high cognitive lock-in, low locus of control, or little desire for independence. Contrary to results reported in previous literature, participants reacted favourably to positive imagery of DVs but *not* vice versa. Implicit attitudes strongly influenced the participants' opinions of DVs.

Keywords: transport marketing; driverless vehicles; non-drivers; behavioural reasoning theory; affect misattribution; driving/travelling phobia; technology acceptance.

Summary Statement of Contribution

The research is the first to examine within the academic domain (i) attitudes towards DVs among non-drivers, and (ii) variables influencing non-drivers' willingness to travel in

driverless vehicles. Explicit attitudes are measured directly; implicit attitudes are assessed via an affect misattribution procedure (AMP). While commonplace in psychology, AMPs have rarely been used to investigate marketing issues. Behavioural-reasoning theory (BRT) is employed to predict attitudes, constituting thereby a fresh contribution to the methodology of attitude determination in the transport marketing domain.

Introduction

Research has examined several aspects of the forthcoming advent of fully automated driverless vehicles (DVs). The latter include autonomous vehicles purchased or leased by consumers, driverless public transport vehicles, and service hire vehicles whereby a DV is summoned and used for a one-off journey (similar to Uber but without a driver). Investigations have covered the benefits and problems of DVs (see, for example, Lenz & Fraedrich, 2014; Litman, 2017; Michael, Kumar & Kumar, 2016); their implications for the management of urban transport systems (e.g., Alessandrini et al., 2015; Fragnant & Kockelman; 2015; Guerra, 2015; Smolnicki, 2017) and factors affecting the (general) public's attitudes towards DVs (e.g., Acheampong & Cugurullo, 2019; Kanwaldeep & Rampersad, 2019; Kyriakidis, Happee & de Winter, 2015; Liljamo, Liimatainen & Pollanen, 2018). These investigations usually focused on drivers rather than non-drivers, as did most studies of willingness to travel in DVs (e.g., Acheampong & Cugurullo, 2019; Alessandrini et al., 2015; Kyriakidis et al., 2015). Studies have typically concluded that drivers' willingness to travel in DVs is by no means certain. For instance, a survey of 233 US drivers undertaken by Kelley, Lane and DeCicco (2019) found that 31% of the participants were unwilling to travel in DVs. Half of the sample members of a survey of 2000 drivers in the USA and Germany conducted by a market research company indicated their intention not to buy or

lease a DV (49%) or use DVs for public transport or other shared journeys (48%) (Here.com, 2017).

An under-researched topic concerns the willingness to travel in fully automated DVs of people who currently do not drive. The sparse literature that does exist on the subject has tended to examine non-drivers who are unable to drive due to medical conditions and/or to physical or intellectual disabilities (see Bennett, Vijaygopal & Kottasz, 2019a; 2019b; Harper, Hendrickson, Mangones & Samaras, 2016); or who prefer not to drive because of the ready availability of public transport, wanting to read or use a mobile 'phone or laptop during journeys, and/or fear of driving (Guerra, 2015; Michael et al., 2016). In 2018/19, twenty-two per cent of UK households did not own or lease a vehicle (ONS, 2019) and, despite an average of around 75% of UK adults holding a full driving licence (81% of males and 70% of females [RAC Foundation, 2019]), not all licence holders actually drive (see end note 1). In general, driving within economically developed countries has become less popular than in the past, and today fewer millennials obtain a driving license and own a vehicle. This is not the case however for older generations, which traditionally have equated car ownership with freedom and independence (Menon, 2017).

The Present Study

The present study examines the characteristics of a sample of 526 current UK non-drivers in relation to their approval or disapproval of the introduction of DVs. The study provides a profile of the sample members, their attitudes (explicit and implicit) towards DVs, and the effects on their willingness to travel in DVs of several variables suggested by prior literature in the autonomous vehicle field. Behavioural Reasoning Theory is employed to explore the explicit and implicit attitudes of non-drivers towards DVs and the connections between

explicit and implicit attitudes and current non-drivers' willing to travel in DVs, either as DV owners/leasers or when using shared public or private transport.

Importance of the Study

Investigations of this nature are important for a number of reasons. Persuading consumers to embrace new automated technologies is one of the most pressing (and sometimes difficult) tasks of marketing management (Nguyen & Simkin, 2017). DV manufacturers seeking to induce current non-drivers to buy or lease DVs, plus government agencies tasked with encouraging non-drivers to be willing to travel in driverless public transport, will need to construct promotional campaigns based on knowledge of non-drivers' attitudes towards driverless transportation (see Acheampong & Cugrullo, 2019; Bennett, Vijaygopal & Kottasz, 2019a; 2019b; Harper et al., 2016). Thus, marketing managers will require knowledge of whether consumers will process customised advertisements, promotions and other communications advocating DVs in the same ways as they process messages about conventional vehicles (cf. Mani & Chouk, 2017; Nguyen and Simkin, 2017) and, critically, of non-drivers' *attitudes* (explicit and implicit) towards DVs. Knowledge of these attitudes will help manufacturers and state agencies to devise the types of message most likely to secure acceptance of DVs (cf. Alessandrini et al., 2015; Donnelly et al., 2016; Smolnicki, 2018; West, 2016).

A further and important justification for the present study is that current non-users of conventional private cars represent a potentially huge market for DVs. Road traffic is estimated to increase between 10%-40% consequent to non-drivers taking to the road (Wadud, MacKenzie & Leiby, 2016). Hence, governments will have to plan and implement transport infrastructures capable of accommodating this additional road usage (Guerra, 2015; Papa & Ferreira, 2018). A substantial part of the new market will consist of people who at

present do not drive due to a disability. Curl and Fitt (2019) noted how DVs should offer substantial mental-health benefits to disabled non-drivers whose mobility is currently restricted and who, in consequence, experience social isolation and loneliness (especially in ageing populations). (Holt-Lunstad et al. [2015] claimed that limited transport options among people with disabilities create mortality risks comparable to those resulting from cigarette smoking.) According to Holt-Lunstad et al. (2015), health sector professionals now have 'a fleeting opportunity to engage in transport technology debates involving the development, product adaptation and introduction of driverless vehicles' (p. 231).

Aims and Contributions of the Study

The aims of the study were:

1. To apply behavioural reasoning theory to predict the explicit and implicit attitudes of current non-drivers towards and willingness to travel in DVs.

2. To assess the degrees of influence on the willingness of current non-drivers to travel in DVs exerted by predictor variables suggested by literature in the autonomous transportation field.

This research was the first specifically to explore the explicit and implicit attitudes towards DVs held by non-drivers and to examine the effects of variables likely to influence their willingness to travel in DVs. It employed an attitude measurement procedure (affect misattribution) which, although commonplace in other academic fields, has rarely been used to investigate marketing issues. From a marketing management perspective, the outputs from the research offer actionable insights into the sorts of campaign and marketing messages necessary to encourage non-drivers to accept DVs. Issues regarding the characteristics of attitudes towards DVs are discussed below.

Nature of Attitudes Regarding DVs

Contemporary attitude theory recognises the existence and importance of implicit as well as explicit aspects of attitude (see, for example, Davos, 2008; Dimofte, 2010; Nosek, Banaji and Greenwald, 2002; Gawronski & Hahn, 2019). Explicit attitudes are constructed 'on-the-spot' via cognitive elaboration of whatever information is provided. They are easily formed and stated on the basis of (sometimes minimal) conscious thought (Calvert et al., 2014; Nosek, 2007) although they can be tempered by social context and may be affected by self-presentation and social desirability considerations. According to Gawronski & Hahn (2019), conventional measures of explicit attitudes 'are not well-suited to capture thoughts and feelings outside of conscious awareness' (p. 29). Hence, conventional measures could fail to detect deep-seated emotions concerning a product that reside in a consumer's mind and which might affect consumer intentions and behaviour (Calvert et al., 2014).

Because driverless vehicles are not currently available, people when questioned may simply 'not know' what to expect of DVs. Consequently, they may have difficulty in explicitly articulating their thoughts about DVs, given that they have limited information and no first-hand experience. An individual may have ideas and reservations about DVs which, for whatever reason, the person would not want to disclose explicitly. For example, the individual might covertly be terrified of travelling in a DV, but not want to be seen as a coward; or could dislike intensely any form of new technology, yet not be prepared to admit to being an old-fashioned technophobe. Also, a person might explicitly voice attitudes about a new technology that the individual believes are highly valued by the individual's social circle, but which do not reveal the person's true attitudes. Thus, both explicit *and* implicit attitudes require consideration, as both play a role in explaining behaviour (Davos, 2008).

Implicit Attitudes

Implicit attitudes are 'introspectively unidentified (or inaccurately identified) traces of past experience that mediate favourable or unfavourable feeling, thought, or action', but which nevertheless play a systematic role in predicting behaviour (Greenwald & Banaji, 1995 p.7). They are involuntarily formed and typically occur without conscious awareness. Wyer (2008) argued that implicit attitudes regarding an unfamiliar product are likely to be based on the most accessible associations and knowledge existing within a person's memory which relate to products *similar* to the unfamiliar product. In the present context the similar product will be conventional vehicles. The mental associations arising from memory enable an individual to make sense of the unfamiliar product, resulting in implicit attitudes which have been inferred from what is already known (Gregan-Paxton & Moreau, 2003).

Attitudes towards DV technology can be nuanced and complex (McCool, 2019), and thus best revealed more comprehensively via implicit measures (cf. Dimofte, 2010). While it has been established that intention to use new technology is substantially predicted by explicit measures, actual behaviour has often been linked in large part to implicit measures (Belletier, Robert, Moták & Izaute 2018). It is necessary, therefore, to study both explicit cognitive processes (occurring through conscious awareness) and implicit cognitive processes (occurring through unconscious/subconscious awareness). Previous investigations of implicit attitudes involving consumers' demands for specific kinds of transportation have mainly involved risk, safety, and violations of traffic rules (e.g., Ledesma, Tosi, Díaz-Lázaro, & Poóab, 2018; Rusu, Sârbescu, Moza & Stancu, 2017). In general, however, and as noted by Ledesma et al. (2018), Martinussen, Sømhovd, Møller and Siebler (2015) and by Mazaheri et al. (2012), research on implicit attitudes within the transport domain is still in its infancy. Marketing and consumer research studies involving implicit attitudes are also uncommon (Dimofte, 2010; Calvert et al., 2014), with numerous subfields requiring exploration.

Theoretical Framework

The study draws on behavioural reasoning theory (Claudy, Garcia & O'Driscoll, 2015; Westaby, 2005; Westaby, Probst & Lee, 2010) which asserts that reasons for liking a new innovation are not necessarily *the direct opposites* of reasons for disliking the innovation, because the factors that affect liking may be quite different to those that influence disliking (Chazidakas & Lee, 2012). Thus, according to behavioural reasoning theory (BRT), research should seek to identify possible reasons why consumers like and accept an innovation, and simultaneously examine possible reasons for rejection. This approach has been employed across many academic fields (see Ryan & Casidy, 2019) and generally has successfully predicted consumer intentions (e.g., Claudy et al., 2015; Gupta & Arora, 2017a; 2017b; Probst & Lee, 2010; Ryan & Casidy, 2019; Sivathanu, 2018; Westaby et al., 2010).

Beliefs, Values and Reasons

Beliefs, which often subsume deeply ingrained long-term values, can result from an individual's upbringing, culture, religion, past experiences, education or indoctrination (Zimmermann, 2007). BRT presumes that reasons exist as consequences of how people process their beliefs and values (Westaby, 2005), a proposition that derives from expectancy value theory (Fishbein and Ajzen, 1975) which holds that beliefs and values exert significant effects on motivational processes. Thus, the processing of information associated with beliefs and values will directly influence the reasons that people employ to explain their attitudes (Pennington and Hastie, 1988). Beliefs and values, according to BRT, serve as a critical precursor to the reasons that individuals employ to justify their feelings and eventual behaviour. Typically, options associated with reasons arising from the most deeply construed beliefs and values will be selected (Bergman, 1988; Westaby, 2005).

Beliefs and Values in Relation to New Technology

As regards innovations, BRT asserts that the reasoning process relating to a new innovation is influenced by a person's deep-rooted values and beliefs about innovation *in general*. These values and beliefs help construe the reasons for and against accepting a particular innovation that develop in a person's mind. Reasons for and reasons against are then mentally balanced up to form and justify attitudes, which then determine intentions to accept or reject (see Claudy et al., 2015). Kim, Chan and Gupta (2007) observed how people's perceptions of the value of technology is a principal determinant of adoption intention, and that beliefs and values are mediated through perceived value. The degree of alignment of a person's general beliefs and values with a *specific* innovation (e.g., DVs) allegedly constitutes a fundamental determinant of the reasons for and against the particular innovation held by the individual (see, for example, Kanwaldeed & Rampersad, 2018; McKnight et al., 2011; Sanbonmatsu et al., 2018; Sundar & Jimirro, 2019). The balance of reasons will actuate the decision whether or not the innovation will be adopted (see Karahanna, 2006; O'Driscoll, Claudy & Peterson, 2013).

BRT assumes that reasons mediate linkages between values and beliefs on the one hand, and attitudes (implicit as well as explicit) on the other. An individual's core beliefs and values about innovatory technology in general may be expected to give rise to reasons conjectured by the person for and against the acceptance of DVs. Accordingly, the following hypotheses are proposed.

H1. Favourable beliefs and values about new technology relate to favouring driverless vehicles.

H2. Unfavourable beliefs and values about new technology relate to not favouring driverless vehicles.

Reasons

Beliefs and values involving an innovation are not equal to reasons, because a favourable belief or value regarding innovation in general might be accompanied by a reason against acceptance of the particular innovation (cf. Westaby, 2005). For instance, a person might strongly believe that new transportation technology will be a great benefit to humankind, yet also think that DVs will be fundamentally unsafe. Reasons, according to Westaby (2005), are 'narrowly focused' on the 'specific subjective factors' and cognitions employed to justify views and actions, and are 'presumed to result from the processing of beliefs' (p. 100).

Several considerations suggest the existence of links between reasons and attitudes and, more specifically, that reasoning rationalises attitudes (McHugh & Way, 2018), Reasons support attitudes because individuals typically feel better about themselves when they possess justifiable reasons that reinforce their attitudes (cf. Pieters & Zeelenberg, 2005). Reasons are useful for providing people with causal self-explanations for their attitudes (Ajzen, 2012). This can bolster self-confidence in evaluations (Westaby, 2005). Thus, reasoning helps promote or protect self-worth (Kunda, 1990). Bagozzi, Bergami and Leone (2003) cite many empirical studies which concluded that individuals employ reasons to support decisions based on attitudes. The perceived acceptability of the attitudes in question are likely to have been derived from the processing of reasons (Pennington and Hastie, 1988). The stronger the reasons for an explanation of a given decision the more coherent the person's attitude concerning the chosen decision alternative and the greater the individual's confidence in the chosen decision (Pieters & Zeelenberg, 2005). A number of studies have posited and demonstrated that cognitive procedures which assess reasons and their justifications can provide an understanding of the "grounds for attitude formation" (Bagozzi, Bergami and Leone, 2003 p.931).

It follows that the more powerful an individual's assumed reasons for accepting DVs, the greater the probability that the person will evaluate favourably the advent of DVs, and vice versa (cf. Mani and Chouk, 2017). Thus:

H3. Expressing reasons favouring DVs leads to favourable explicit and implicit attitudes regarding DVs.

H4. Expressing reasons against DVs leads to unfavourable explicit and implicit attitudes regarding DVs.

In addition to the effects of beliefs and values on the mediating reasons, it is necessary to provide for the possibility that beliefs and values could exert direct influences on attitudes, independently of the mediating variables. This direct link with attitudes is, in the words of Westaby (2005), 'expected because of automated processes that might circumvent deeper reasoning activation' (p. 100). Accordingly, it is suggested that:

H5. .Favourable beliefs and values about new technology relate to favourable explicit and implicit attitudes towards driverless vehicles while unfavourable beliefs and values about new technology relate to unfavourable explicit and implicit attitudes towards driverless vehicles.

Attitudes and Intentions

Investigations based on the theory of reasoned action (Fishbein & Ajzen, 1975) and the theory of planned behaviour (Ajzen, 1985) have consistently confirmed that a positive attitude towards an item is a significant predictor of intention to buy and/or to use the item. Sahu, Padhy and Dhir's (2020) review of BRT literature found that, of all motives, attitude was the most cited construct for predicting behavioural intention. This situation has been found to apply to implicit as well as explicit attitudes (Fazio and Olson, 2003; Perugini, 2005). Attitudes are expressions or applications of beliefs and values and as such (i) are

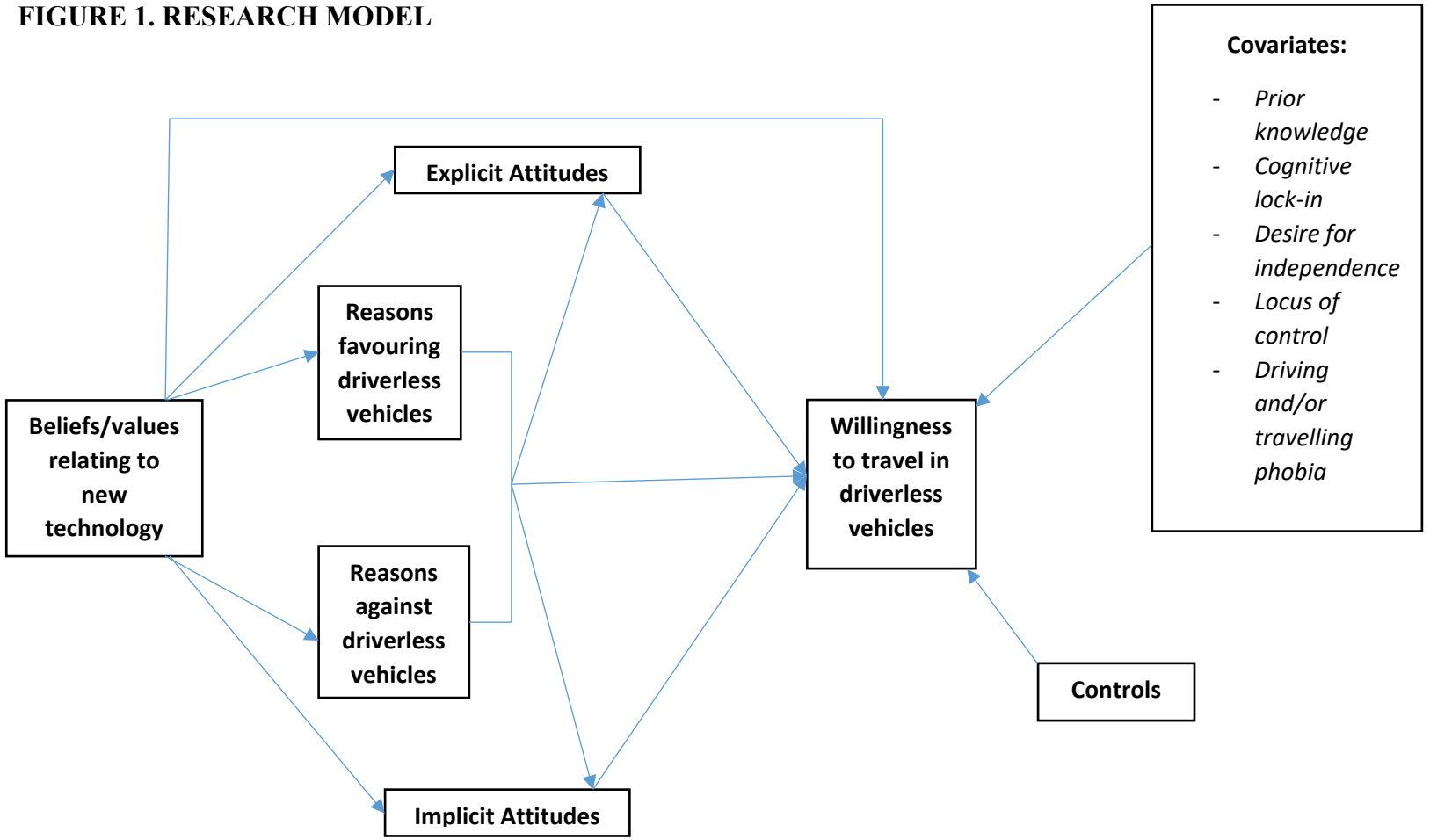
secondary to beliefs and values (Bergman, 1988; Eagly & Chaiken, 2007; Fazio & Olsen, 2003), and (ii) mediate connections between beliefs/values and intention (Ajzen, 1991). They differ from beliefs and values in that, whereas a belief is a conviction and a value is an expression of what is important to a person; an attitude is a predisposition to act (Modva, 2016). (Willingness to travel in a DV is the intended activity in question in the present investigation.) The stronger the attitude the greater the intention to act (Ajzen, 1985; 1991). A substantial amount of literature has demonstrated that this connection applies specifically to the acceptance of innovations (e.g., Claudy et al., 2013; 2015; Gupta and Arora, 2017a; 2017b; Lu, Yu, Liu, C. & Yao, 2003; Pavlou & Fygenson, 2006). Hence:

H6. Favourable attitudes (explicit and implicit) towards DVs relate positively to willingness to travel in DVs.

The present research follows Westaby (2005) in positing that reasons can exert direct effects on willingness to travel in a DV without the mediating influence of attitudes. According to Westaby (2005), 'reasons capture justifications and defence mechanisms that, irrespective of attitudes, maintain people's self-worth', thus making them feel more comfortable with themselves in relation to travelling in a DV (Westaby, 2005, p. 100). Claudy, Peterson and O'Driscoll (2013) suggested that this direct impact could arise from people attempting to simplify decision making by using cognitive short cuts. Sometimes, an intention might be formed on the basis of a critical reason that is especially relevant to an adoption decision. Thus, reasons may explain behavioural intentions over and above that explained by attitudes. A similar argument applies to the existence of a direct link between beliefs/values and willingness to travel in a DV. Thus:

H7. Expressing reasons favouring DVs positively relates to willingness to travel in driverless vehicles.

FIGURE 1. RESEARCH MODEL



H8. Expressing reasons against DVs negatively relates to willingness to travel in driverless vehicles.

H9. Favourable beliefs and values about new technology positively relates to willingness to travel in driverless vehicles.

Research Model

Figure 1 presents the model tested in the present investigation. Beliefs and values vis-à-vis new technology are posited to give rise to cogitation regarding reasons for and against DVs, which are cognitively balanced to determine explicit attitudes and implicit attitudes. Reasons for and against have direct influences on willingness to travel. Explicit and implicit attitudes also affect a person's willingness to travel in a DV.

Since the latter will be affected by considerations complementary to explicit and implicit attitudes towards DVs, the model includes key covariates that past literature has found to predict willingness to travel in a DV. In line with previous research in the area, demographic details (age, gender, etc.) are also employed as controls. The variables in question are detailed below.

Covariates

Driving and Travelling Phobia

Some non-drivers are afraid of driving. A relevant question is whether current non-drivers who fear driving will also fear travelling (often alone) in a DV. Fear of driving is frequently referred to as 'driving phobia' and may extend to travelling in vehicles (including public transport vehicles, taxis or other shred transport) but without driving them (Taylor & Sullman, 2009). According to Wald and Taylor (2000), driving phobia 'is characterised by intense, persistent, irrational fear of driving that increases as the individual anticipates or is

exposed to driving stimuli' (p. 249). It is a dysfunctional condition that restricts a person's freedom to travel and hence impedes the individual's independence (Da Costa et al., 2014). Affected individuals are either 'unable to drive, or tolerate driving with considerable distress' (Wald & Taylor, 2000 p.249).

The contents and causes of driving phobia are complex (Taylor, Alpass, Stephens & Towers, 2011) and may result from a situation or a bad experience, or be part of a wider agoraphobia (Taylor, Deane & Podd, 2000) or a technophobia involving a fear that negatively impacts acceptance of new technologies (Khasawneh, 2018). Common antecedents are fears of having a panic attack while travelling (trembling, sweating, etc and the shame of being seen in this condition); fear of accidents, injury or breaking down; feelings of loss of control over a vehicle; and perceptions of dangerous road conditions and/or bad driving by others. Ehlers, Hofmann, Herda and Roth (1994) delineated an inventory of 14 possible aspects of driving and/or travelling phobia that motorists (or their passengers) might experience. Hence:

H10. Driving and travelling phobia negatively relates to willingness to travel in driverless vehicles.

Prior Knowledge of DVs

Many surveys of public attitudes towards DVs have concluded that prior knowledge of the characteristics of DVs contributes positively and significantly to people's views about such vehicles (see for example Bennett et al., 2019a, 2019b; Charness et al., 2018; Konig & Neumayr, 2017; Nordhoff et al., 2019; Pettigrew et al., 2019). Anania et al. (2018) found substantial and significant correlations between the *types* of information seen by an individual and the person's willingness to travel in a DV. Participants in Anania et al's study were more willing to travel in DVs after hearing positive information about them, and vice versa (cf. Weinberger & Lepkowska-White, 2000).

DVs have yet to appear on highways, so members of the public have no direct experience of travelling in them. Thus, a person's knowledge of DVs is obtained from the mass media, exposure to advertisements, television programmes about DVs, articles in newspapers or magazines, and from conversations with friends, relatives and work colleagues (cf. Moons & De Pelsmacker, 2012; Rezvani, Jansson & Bodin, 2015). Within the general automotive field, it is known that prior knowledge is an important cause of how people think about a particular type of vehicle and how they rationalise their views regarding its characteristics (Cheron & Hayashi, 2001; Egbue & Long, 2012; Rezvani et al., 2015). Allegedly, individuals who possess large amounts of prior knowledge have greater focus and exercise more discrimination when assessing the features of an automotive product. It follows that prior knowledge might help determine an individual's attitudes towards DVs, and also the person's sense of self-confidence when contemplating travelling in a DV (Park & Lessig, 1981). Accordingly:

H11. Prior knowledge of DVs positively relates to willingness to travel in driverless vehicles.

Locus of Control

The term 'locus of control' (LoC) describes people's expectations of their abilities to control events, environments or outcomes (Rotter, 1966). High 'internal' LoC refers to the belief that events and outcomes are determined by an individual's own effort and ability and not by chance or external factors. LoC is highly relevant for investigations of willingness to travel in new forms of transport because LoC can influence attitudes towards safe travel, feelings of competence vis-à-vis a new form of transport, and degrees of trust in a new technology (Huang & Ford, 2012; Özkan & Lajunen, 2005). Studies have concluded that high internal LoC has an important positive impact on the adoption of safe behaviour in traffic and on the

avoidance of accidents (Huang & Ford, 2012; Mazaheri, Hidarnia & Ghofranipour, 2012). According to Huang & Ford (2012), individuals with high internal LoC will perceive the dangers of the road more acutely and will 'tend to interpret outcomes as their own behaviour, will attribute outcomes to controllable factors, and be more likely to take precautionary measures' (p.38).

Such findings suggest that individuals with low internal locus of control could fear the use of a fresh and untried means of transport. Conversely, people with high internal LoC (who believe that they can exert control over different outcomes of their lives) might welcome the introduction of driverless vehicles. Critically, research has found that individuals with high internal LOC are significantly more likely to be open to fresh innovative ideas (Burroughs & Glen Mick, 2004; Potosky & Bobko, 2001), and to adopt innovative products earlier than others (Schreier & Prügl, 2008). Again, this implies that people with high internal locus of control might possess favourable attitudes towards DVs. In addition, high locus of control could be associated with positive perceptions regarding the ease-of-use of a driverless vehicle. An opposing view is that because a person who travels in a DV has no control over the operation of a vehicle, locus of control is irrelevant vis-à-vis the individual's attitudes to DVs. (see Lee, Lee, Park & Lee [2019] for a discussion of this issue).

The effects of LoC on *drivers*' attitudes to DVs have been examined in a number of studies (e.g., Choi & Ji, 2015; Nordhoff et al., 2016; Payre, Cestac & Delhomme, 2014). To date, however, the role of LoC as a determinant of the attitudes of non-drivers towards DVs has not been investigated.

H12. Locus of control positively relates to willingness to travel in driverless vehicles.

Desire for Independence

Non-drivers who acquire fully automated DVs will have opportunities to travel, at will, to previously inconvenient places. Possession of any type of automobile enables a person to experience greater levels of freedom of travel and hence to attain higher levels of independence than before the vehicle was acquired (D'Costa, 2013; Ker & Tranter, 1997). In particular, non-drivers with physical or intellectual disabilities should have considerably more independence consequent to the introduction of DVs (Bennett et al., 2019a; 2019b). Research has established that people possess disparate levels of innate need for independence (Montarzino et al., 2007; Nagurney, Pomerantz, 2019; Reich & Newsom, 2004), suggesting that attitudes towards DVs may be more favourable among people who deeply value their independence.

H13. Desire for independence positively relates to willingness to travel in driverless vehicles.

Cognitive Lock-in

Consumer habit could constitute a source of potential resistance to DVs (Labrecque et al., 2017). Strength of habit associated with a non-driver's current mode of transport might encourage resistance to a novel means of transportation such as DVs (cf. Sheth, 1981), because individuals might consciously prefer an existing, habitually-used mode of transport (Kleijnen et al. 2009). Consumers' habitual use of a certain mode of transport (e.g., cycling or public transport) could impede a transition to a new method. This may occur via a rational decision-making process that evaluates (i) past investments (in time and effort taken to become familiar with a currently used transport method), plus (ii) the costs of switching in terms of time and effort and possibly new financial costs (hire or purchase of a DV for instance), and balances these against the benefits of a new and untried means of travel.

Decision-making of this nature is referred to as cognitive lock-in (see Murray & Häubl, 2007; Zauberman, 2003). It involves an individual performing a psychological cost-benefit analysis through which the decision-taker concludes that the costs and inconvenience of switching from an incumbent mode of transport outweighs the benefit of using an alternative (DVs in the present context) (cf. Klemperer 1987; Shapiro & Varian 1999). Repeated experience with an incumbent mode of transport can increase the perceived value of the incumbent mode relative to others (cf. Johnson, Bellman & Lohse, 2003; Murray & Häubl, 2003; Ratchford, 2001).

H14. Feelings of cognitive lock-in negatively relate to willingness to travel in driverless vehicles.

Materials and Methods

An online questionnaire covering the variables in Figure 1 was prepared, as summarised in the Appendix to the paper. The items used to measure variables are listed together with the literature sources from which they were obtained. For the reflective constructs indicated in the Appendix, Cronbach's alpha values and percentages of variation explained by the leading factors emerging from factor analyses of each of the multi-item constructs are provided. Apart from factual queries, items were evaluated using five-point agree/disagree scales; reverse scored in appropriate cases.

Reasons for and Against DVs

Academic literature on autonomous vehicles is replete with arguments for and against DVs. Alleged benefits of DVs include the absence of driving-related stress (Acheampong & Cugurullo, 2019; Papa & Ferreira, 2018), safer journeys (Alessandrini et al., 2015; Kyriakidis et al., 2015; Lenz & Fraedrich, 2014; Smolnicki, 2018), and self-parking by DVs (Alessandrini et al., 2015). Also, people who own or lease DVs will be able to share the

advantages currently available only on public transport, as ride share passengers or in taxis of being able to relax and enjoy a journey while reading, gazing at scenery, etc. (Cohen & Hopkins, 2019; Fraedrich, Cyganski & Lenz, 2015; Papa & Ferreira, 2018). Moreover, DVs will be able to travel door-to-door, hence avoiding problems relating to the journey from home to a bus or railway station and then from an exit bus or railway station to a traveller's final destination frequently associated with public transport (Smolnicki & Soltjys, 2016). This last point is especially important for the elderly and people with disabilities (Acheapong et al., 2018).

Arguments against DVs extend to (greatly) increased road congestion (Acheampong & Curugullo, 2019; Litman, 2017; Smolnicki, 2018), extra 'urban sprawl' (Acheapong et al., 2018; Smolnicki, 2016; 2017), lack of trust in new technology (Adnan, Nordin, Bahruddin & Ali, 2018; Lenz & Fraedrich, 2014; see also Mulcahy et al., 2019), concerns relating to the reliability of vehicle GPS systems and possibilities for malevolent hacking (Acheapong et al., 2018; Kencebay, 2019); lack of control (Mani & Chouk, 2019; Murray, 2017; OECD, 2017; Xu et al., 2018) and fear of collisions with conventional vehicles (Donnelly et al., 2016; McNight et al., 2011; Smith, 2014; Smith and Anderson, 2017).

To establish reasons for and against DVs specifically relevant to non-drivers, the present study employed the outcomes to an earlier investigation completed by the authors (Authors, 20XX). This provided five reasons in favour of using DVs and five reasons against from the reasons given by the non-driving proportion of a sample of UK adults. The earlier study asked 106 non-drivers to complete a questionnaire relating to various issues concerning DVs and, (in addition and in anticipation of the present study) to (i) 'please name reasons for and against using DVs', and then to (ii) rate the 'importance' of each reason on five-point scales (5=extremely important; 1=not very important) (cf. Cymbala & Owczarczuk, 2011). A typical respondent would specify three or four reasons for each category. The five reasons for

and against DVs mentioned most frequently and deemed most important by the respondents were used in the current investigation (cf. Claudy, Peterson & O'Driscoll, 2013; Sivathanu, 2018). These items did in fact generally match those of the abovementioned previous empirical studies of public opinion regarding DVs.

Explicit and Implicit Measures of Attitude

Explicit Measure

Following standard practice in studies involving the theory of planned behaviour and its variants (see Ajzen, 2006; Francis et al., 2004), explicit attitudes were measured using generally construed 'good versus bad' items (see the Appendix). In line with the practice of past AMP studies, the participants in the present investigation (see below) were asked to evaluate these items at the end of the questionnaire (see Mann, Cone, Heggeseth & Ferguson, 2019).

Implicit Measure

Implicit measures of attitude, according to Dimofte (2010), should be used as a matter of course in marketing research due to their 'potentially superior ability to gather accurate construct measurement data despite consumers' reluctance or inability to provide them' (p. 924). It is relevant to observe that correlations between implicit and explicit attitude measures typically reported in past literature had coefficients with values between .25 and .4, indicating the dangers attached to basing assessments only on explicit measures (Mann et al., 2019). A common measure of implicit attitudes is the Implicit Association Test (IAT) (Greenwald, McGhee, & Schwartz, 1998). More recently, the Affect Misattribution Procedure (AMP) (Payne, Cheng, Govorun & Stewart, 2005) has become a popular alternative to the IAT. AMP studies are common in social psychology research (see Mann et al., 2019) but not in the fields

of transportation and marketing (see end note 2). Dimofte (2010) argued that future consumer research should expand the use of implicit measures beyond the IAT.

The AMP

An AMP investigation presents a person with a 'prime' consisting of a picture and/or words (or phrases) relating to an object of interest for a short period on a computer screen. Then the participant sees for a short time a 'target' comprising a fractal image such as an ink blob or a meaningless image (e.g., a letter from the alphabet of an unknown foreign language [see end note 3]). The individual is instructed not to evaluate the prime, only the target, which is now masked. Then the participant must quickly indicate whether the target is 'less (or more) visually pleasing than average' (the words good and bad were used in some studies). (Research undertaken by Eker and Bar-Anan [2015] found no differences in results when a one-to-six scale rather than a binary question was employed to measure responses.)

The AMP measures 'automatically activated responses based on the misattributions people make about the sources of their affect or cognition' (Payne & Lundberg, 2014). Hence, it assesses 'the degree to which the evaluation of the prime is *misattributed* to the ambiguous target' (Mann et al., p. 351). Any systematic effects of the prime on participants' tendencies to classify the target as more or less pleasant than average is interpreted to comprise their unintentional evaluation of the prime, which was *misattributed* to the target. Observed misattributions are assumed to be unintentional implicit reflections of true attitudes. Pleasant judgements of a target are assumed to 'serve as a proxy for implicit attitudes towards the prime' (Blaison et al., 2112, p. 403). Allegedly, the AMP 'predicts judgements and behavioural outcomes above and beyond self-report measures' (p. 404).

Advantages of the AMP relative to the IAT (and similar methods) are that the AMP involves simple instructions and takes little time to complete. It does not rely on reaction

times (which can vary among people with identical attitudes) and, like the IAT, is not susceptible to self-presentation motivations. As with the IAT, test subjects in an affect misattribution study cannot analyse information before responding, hence revealing potentially hidden attitudes yet avoiding social responsibility bias. Allegedly, the AMP has superior psychometric properties (consistency, reliability, etc.) when compared to the IAT (Blaison et al., 2012; Gawronski & Hahn, 2019; Payne & Lundberg, 2014; Znanewitz et al., 2018).

Some AMP studies employed words as the main components of primes, thus substantially broadening the AMP's potential applicability (see for example Eder & Deutsch, 2015; Gawronski & Hahn, 2019; Gawronski & Ye, 2004). Word primes have been found to be successful, so long as the words in question related clearly to the object of the research and evoked attitudes reflected in the evaluations of targets (Deutsch & Gawronski, 2009; Gawronski & Hahn, 2014). In the present study the participants were shown words beneath four simple pictures (the order of presentation of which was randomised) of driverless vehicles in appropriate contexts. Two of the pictures displayed DVs in a positive light, i.e., (i) two suited business men playing a board game while travelling in a DV, together with the words 'Driverless cars are a wonderful idea that will make the world a better place', and (ii) a person lying and relaxing in a DV travelling on a city freeway, accompanied by the words 'Driverless cars are a fantastic new technology that will benefit mankind'. Two pictures gave negative views of DVs, i.e., (i) the remains of a mangled vehicle after a crash on a motorway, accompanied by the words 'Driverless cars are a truly horrifying invention', and (ii) a vehicle in a scrapyard with the vehicle's front half having been destroyed in an accident, together with the words 'All in all, driverless cars are a truly stupid invention'. Selection of these pictures resulted from an exercise in which 44 non-drivers (20 university employees; seven part-time MBA students and 17 people recruited through mall intercepts) were shown 22

pictures downloaded from Internet sources by the authors and asked to sort the pictures into four categories corresponding to four abovementioned dimensions, with the most relevant picture on the top of each division.

To choose the phrases accompanying the pictures, members of the same sample were asked to select from a list of 15 phrases praising DVs the phrases that were the most favourable. The same process was employed to select the most unfavourable phrases. The 30 phrases themselves were based on words and phrases used by the public to describe the characteristics of driverless vehicles during a previous study (Authors, 20XX). Participants were requested to evaluate the targets (Tibetan letters) as pleasant or unpleasant on four-point scales (cf. Ecker & Bar-Anan, 2015). Valence was used to appraise the targets because the first pre-test of the model revealed that valence generated much sharper results than those obtained from the use of the words 'good' or 'bad'.

Pre-tests and the Main Sample

An initial pre-test of the model shown in Figure 1 was completed using a convenience sample of 35 non-driving employees at the authors' universities plus non-driving members of a part-time MBA programme, all of whom were in full-time employment. The AMP (using Inquisit software [Millisecond Software, LLC]) was administered to the participants in the Behavioural Science Research Laboratory of XXX university. Outcomes to the first pre-test were discussed with six experts (three in consumer behaviour and three in the field of transportation) and a second pre-test was undertaken having removed or modified overlapping or unclear questionnaire items. Next, the pictures and their accompanying phrases, together with the Tibetan characters, were incorporated into a questionnaire containing a 3,000-millisecond time-limited exposure of each picture. (This period is rather longer than the period applied in many AMP studies due to the questionnaire set-up of the

present investigation and the time required by participants to access and view the primes depicted in on-line pages.) Although, in some cases, longer exposure times might influence participants' reactions to a prime through allowing people to observe and interpret the source more fully (and hence to give biased responses [Murphy & Zajonc, 1993]), this was unlikely in the present study. Pre-tests completed prior to the main investigation experimented with different exposure times and it emerged that very short exposures resulted in the participants not being able to recall anything whatsoever related to the prime. It is relevant to note that the AMP has been found to be robust with respect to variations in exposure times both for primes and targets (Payne et al., 2005). The environment of an online administration of a prime differs to that of a laboratory situation, and needs to take into account the process of scrolling onto a page containing a picture. The revised questionnaire was distributed to panel members of a commercial market research company (QualtricsXM UK). Panel members were filtered by Qualtrics to ensure that all the participants were non-drivers and that the profile of the sample matched that of non-driving UK adults as a whole.

A second pre-test was completed on the first 50 responses, leading to minor adjustments to the questionnaire. The research company then gathered (within six days) 420 responses to the final version of the questionnaire (the maximum available given the budget for the study). A further 106 responses from non-driving adults were obtained independently by the authors via various social marketing platforms. These responses closely matched those obtained by the research company and thus were merged into a 526-strong main sample. Table 1 lists the characteristics of the sample members. Because the study employed visual imagery and required cognitive analysis and interpretation, it was not possible to include in the sample people with significant visual or intellectual impairments. Attitudes towards autonomous vehicles held by people who are blind, individuals with mental health

Table 1. Characteristics of Sample Members

Age (mean)	39.6 years
Gender (% female)	57%
Income level, self-reported as: Below average About average Above average	 12% 56% 32%
Has a post-school educational qualification (post-graduate; degree/post-school diploma/professional qualification; matriculation qualification)	31%
Frequency of use of transportation Daily 3 or 4 times a week Once a week Once every 2 weeks Once every 3 weeks Once every 4 weeks	 24% 44% 16% 8% 8% 0%
Location urban/rural (% urban)	83%
How do you usually travel? I get lifts from family friends I get taxis I use public transport I walk or cycle	 40% 27% 64% 27%
Has a full driving licence	15%
Number of accidents involving motor vehicles: Zero One Two Three Four More than 4	 62% 19% 12% 5% 2% 0%

disabilities, and non-drivers with severe ambulatory disabilities were examined in separate investigations prior to the present study (Authors 2019a; 2019b; 2020).

Results

Descriptive Results

Just over half (52%) of the participants agreed or strongly agreed that they would be willing to travel in a DV; 26% were opposed to the idea. Agree/strongly agree (A/SA) and disagree/strongly disagree (D/SD) responses were calculated for the average values of each construct in the model. Response data for the averaged items of the driving phobia variable had two peaks: 40% A/SA and 40% D/SD. The former peak is almost identical to the outcome of a survey of 2000 *drivers* completed by the Nissan Motor Company which found that 39 per cent of motorists 'felt scared, nervous, uneasy or uncertain behind the wheel in general' (Hearn, 2018). Sixty-four per cent of the members of present sample responded in the averaged A/SA categories for locus of control. The corresponding figure for desire for independence was 41%; for cognitive lock-in 34%; and for prior knowledge of DVs 18%.

Diagnostics

Construct reliabilities of the reflective constructs in the model were assessed using the Cronbach's alpha statistic. The results are shown in the Appendix to the paper and, since all the alpha values exceeded the recommended threshold of .7 it is concluded that the scales are trustworthy and internally consistent (Nunnally and Bernstein, 1994). Construct validity is presumed because all the scales employed (i) were based on previous academic literature wherein the relevant scale items had been validated, and (ii) the scales had been used in pre-tests prior to the estimation of the model using the full sample. Discriminant validity vis-à-vis the reflective constructs was measured firstly via Henseler, Ringle & Sarstedt's (2015) HTMT statistic and secondly using the Fornell-Larcker (1981) criterion. The former accepts evidence of discrimination if HTMT values are below .9. In the present study the HTMT

Table 2. Model Estimation: Explicit Attitudes

Antecedent Variables	**Consequent Variables**			
	Reasons for acceptance	Reasons for rejection	Explicit attitudes	Willingness to travel in an AV
Age				.16 (2.77)**
Education				.15 (2.1)*
Beliefs/values	.50 (4.77)**	-.10 (1.40)	.40 (3.88)**	.43 (4.55)**
Reasons for acceptance			.58 (5.52)**	.55 (5.00)**
Reasons for rejection			.09 (1.00)	.10 (1.46)
Explicit attitudes				.51 (4.98)**
Cognitive lock-in				-.15 (2.55)**
Locus of control				.20 (3.01)**
Driving and/or travelling phobia				.19 (2.38)**
Desire for independence				.24 (3.39)**
Prior knowledge of DVs				.04 (1.01)
R-square	.25	.01	.37	.44

*indicates significance at p<.05. **indicates significance at p<.01 or below.
Stone-Geisser Q^2 = .39. Standardised Root Mean Square Residual =.068.

Table 3. Model Estimation: Implicit Attitudes – Positive Imagery

Antecedent Variables	**Consequent Variables**			
	Reasons for acceptance	Reasons for rejection	Implicit attitudes	Willingness to travel in an AV
Age				.16 (2.31) *
Education				.20 (2.66)**
Beliefs/values	.44 (4.00)**	-.08 (1.11)	.23 (3.26)**	.40 (3.77)**
Reasons for acceptance			.25 (2.99)**	.46 (3.88)**
Reasons for rejection			.10 (1.26)	.10 (1.22)
Implicit attitudes				.28 (2.76)**
Cognitive lock-in				-.19 (2.90)**
Locus of control				.19 (2.66)**
Driving and/or travelling phobia				.17 (2.05)*
Desire for independence				.29 (3.11)**
Prior knowledge of DVs				-.05 (0.07)
R-square	.20	.01	.26	.55

*indicates significance at p<.05. **indicates significance at p<.01 or below.
Stone-Geisser Q^2 = .29. Standardised Root Mean Square Residual =. 069.

Table 4. Model Estimation: Implicit Attitudes – Negative Imagery

Antecedent Variables	**Consequent Variables**			
	Reasons for acceptance	Reasons for rejection	Implicit attitudes	Willingness to travel in an AV
Age				.15 (2.00) *
Education				.18 (2.00)*
Beliefs/values	.40 (4.04)**	-.04 (.91)	.03 (0.26)	.51 (4.87)**
Reasons for acceptance			.09 (0.99)	.40 (2.96)**
Reasons for rejection			.10 (1.22)	.05 (0.24)
Implicit attitudes				.08 (0.76)
Cognitive lock-in				-.15 (2.96)**
Locus of control				.18 (2.55)**
Driving and/or travelling phobia				.20 (2.83)*
Desire for independence				.24 (2.88)**
Prior knowledge of DVs				.10 (1.01)
R-square	.17	.002	.04	.46

*indicates significance at p<.05. **indicates significance at p<.01 or below.
Stone-Geisser Q^2 = .40. Standardised Root Mean Square Residual =.077.

statistics for all pairs of reflective constructs were between 4.0 and 5.7, suggesting sound discrimination. Average variance extracted figures varied between .52 and .69, and exceeded the R^2 values between the variables (all $R^2 < .22$) thus satisfying the Fornell-Larcker (1981) criterion.

As the same respondents gave answers to all the independent variables as well as the dependent variable, it was necessary to test for the possible presence of common method bias. This was completed by (i) entering the mean values of all the constructs covered by the questionnaire into a single principal component factor analysis, and (ii) examining the responses for indications of 'yea saying' (Schaller, Patil, & Malhotra, 2015). No evidence of common method bias was detected. Fitting a single common factor to the means of all the variables in a confirmatory analysis gave a poor fit: GFI=.65; RMSEA=.17. Wave effects were unlikely considering that most of the data was collected within a short period. However, a comparison of 'early' and 'late' responses was undertaken and this did not indicate any meaningful disparities. Variance inflation factors for all the variables were less than value five, confirming the absence of serious problems connected with multicollinearity (Hair, Black, Babin and Anderson, 2010).

Estimation of the Model

Figure 1 was tested as a structural equation model using the method of partial least squares. The bootstrap facility of the SmartPLS software package (Ringle, Wende & Becker, 2015) was employed for the estimations (5,000 runs). Partial least squares was used because the responses for four of the constructs (locus of control, desire for independence, prior knowledge of DVs and driving phobia) were not normally distributed and the items measuring cognitive lock-in and reasons for and against DVs were formative rather than reflective in nature. Several estimations were completed: once using explicit attitudes as the

mediating variable, once each for the two favourable pictures of DVs acting as the mediator and once each for the two negative pictures of DVs as the mediator. Averaged responses to the two favourable images and to the two unfavourable images were not considered because each picture (and accompanying phrase) displayed a *different* facet of DVs. Nevertheless, the correlations between the participants' evaluations of the targets for each pair were substantial (R = .74 and R = .77 respectively). The results of the estimation using explicit attitudes as the mediating variable are shown in Table 2.

Outcomes to the estimation of the model with the second favourable picture as the mediator were very similar to, and generated the same patterns of outcomes as, the results for the first favourable picture. Thus, only the outcomes relating to the first favourable picture are presented (see Table 3). The same situation applied to the results for the estimations using the two unfavourable pictures. Hence, Table 4 shows the outcomes only for the model with the first unfavourable picture as the mediating variable. Only two of the controls, i.e., age and education, attained significance ($p<.05$) in any of the regressions. The older and the better educated an individual the more likely that the person would be willing to travel in a DV. As the controls were not associated with specific research questions, non-significant controls were removed from the remainder of the analysis.

The predictive validity of the model was examined by removing every seventh data point of the willingness to travel variable and re-estimating the model. Stone-Geisser Q^2 values are shown in Tables 2 to 4, all indicating adequate prediction. Next, the attitude variable was removed from each of the estimations and the blindfolded models were rerun. The effect sizes of the omitted attitude variable were substantial ($f^2 = .40$; .45 and .39 respectively) demonstrating the importance of the links between attitude and willingness to travel in an AV. The variable "Driving and/or travelling phobia" was tested for possible moderating effects on the links firstly between beliefs/values and willingness to travel and

secondly between attitudes and willingness to travel. Then, locus of control and cognitive lock-in were employed as potential moderators of these links. Since cognitive lock-in was measured as a formative construct and as the aim of testing the other two moderators was to assess their possible influences on key relationships, the SmartPls two-stage procedure was used for the estimation (see Hair, Hult,, Ringle and Sarsedt, 2017). The effect sizes of the moderators were small (f^2<.008 in all cases) and all T-values on moderating coefficients were insignificant (T<1.0 in all cases).

Answers to the Research Questions

The non-drivers most likely to be willing to travel in DVs in the present sample were older and better educated than others, believed strongly in the benefits of new technology (confirming H1), exhibited high locus of control (confirming H12), low cognitive lock-in (confirming H14), and desired greater levels of independence (confirming H13). A significantly *positive* connection existed between the degree of a person's driving phobia (including travel in public transport) and the individual's willingness to travel in DVs (rejecting H10), meaning that people with high levels of driving/travelling phobia welcomed the prospect of autonomous vehicles that were not controlled by a human driver. Correlations between the items measuring driving phobia and the items for reasons in favour of DVs averaged 0.29 (p = .000), indicating greater trust in DVs compared with human drivers who could make driving errors. Prior knowledge of DVs failed to attain significance at the .05 level in any of the estimations, thus rejecting H11.

As regards BRT, the estimation of Figure 1 provided a good fit to the data; with one (important) exception, i.e., the insignificance of reasons against using DVs (rejecting H2, H4 and H8). Apart from this irregularity and the insignificance of prior knowledge of DVs, the estimated model displayed strong pathways, sound R-squares, and satisfactory diagnostics for discriminant and convergent validity. Hypotheses two, three, five, six, seven and nine are

supported. The variable ‘reasons against using DVs’ was insignificant in all the estimations and regardless of whether explicit or implicit attitudes were included. It was not influenced significantly ($p<.05$) by beliefs and values vis-à-vis new technology, and did not exert a significant impact on attitudes or on willingness to travel in a DV. It seems that strong beliefs and values concerning new technologies triggered mainly positive opinions regarding reasons for liking DVs, but this did not happen with respect to negative assessments of reasons against DVs. Thus, some individuals who scored highly on beliefs/values in new technology gave low scores for reasons against DVs, but some gave high scores. Hence there was no distinct pattern of responses linking beliefs/values with this particular variable. Strong beliefs/values in favour of new technologies did not trigger any systematic responses in relation to the ‘reasons against’ variable.

In all other respects the variables suggested by BRT performed as expected and, overall, the results confirm the efficacy of behavioural reasoning theory. The covariate ‘prior knowledge of DVs’ was insignificant, but this variable was not connected to BRT. Correlations between the two positive-image implicit attitude measures and the explicit attitude measures averaged .29 ($p = .000$). The corresponding figure for the two negative images was -.27 ($p = .000$). These values correspond with the findings of previous literature on the matter (see for example Davos, 2008; Dimofte, 2010; Gawronski & Hahn, 2019). Outcomes to the present study concur with the results of previous investigations which found that measures of explicit attitudes do not adequately determine people’s true and comprehensive attitudes.

Discussion and Conclusion

Willingness to travel in a DV increased with respect to age. This was an unexpected result as much literature has concluded that willingness to engage with new technology declines as people get older. Nevertheless, a ‘survey of surveys’ completed by Anderson and Perrin

(2017) concluded that, today, 'many seniors have a positive outlook about technology and the benefits it can provide and once online, many older adults engage deeply with online content and activities' (p.1). If this is true, manufacturers and government agencies need not produce separate promotional materials for young and old audiences or target media catering specifically for one age group. The significance of education level as a covariate suggests perhaps that the better educated people in the sample were more open-minded about the acceptance of new technologies than was the case with less-educated individuals. However, contrary to many past studies which found that prior knowledge of DVs exerted powerful influences on *drivers'* willingness to accept autonomous vehicles; prior knowledge had no significant influence on willingness to travel in a DV among the present sample of non-drivers. A reason for this could be that, by definition, non-drivers do not drive and therefore will have no interest in matters related to motor cars or other vehicles (e.g., car maintenance, vehicle prices and performance data, insurance). Hence, non-drivers may have simply ignored any information on DVs presented in newspaper or magazine articles, in TV features or in social media. Implicit attitudes towards DVs that were created casually and based on scanty information might be important amongst such people; an issue ignored by previous investigations.

Just over half (52%) of the sample members agreed or strongly agreed that they were willing to travel in a DV, with only 26% disagreeing or strongly disagreeing. This suggests that many current non-drivers will want to acquire driverless cars as soon as they become available at reasonable prices. In particular, people with disabilities that currently prevent them from driving will be able to travel extensively using DVs, with consequent improvements in both their physical and mental well-being (Bennett et al., 2019a; 2019b). Government transport authorities need to be aware of this possibility as it has serious implications for the development of national transportation infrastructure.

The results imply that manufacturers' advertisements and government public information campaigns targeted at non-drivers should contain messages that appeal to their positive beliefs and values regarding the advent of the new technology of DVs, emphasising fresh travel opportunities for non-drivers and greater personal independence. Promotional messages should contain the sorts of reasons for acceptance of DVs listed in the Appendix. Apparently, reasons against using DVs might not be important for non-drivers, suggesting that there is little need for promotional materials to dwell on how negative thoughts may be assuaged. Individuals with high levels of cognitive lock-in might be persuaded to accept DVs through rational appeals emphasising the benefits of DVs when compared with their perceived (often psychological) costs. People with low locus of control could be attracted to DVs via messages based on the unlikelihood of breakdowns, ease of control of a DV, and the ability to stop the vehicle or change the destination by simply pressing a button. Similar comments apply to non-drivers with high levels of driving/travelling phobia. The greater the extent to which a participant exhibited driving phobia the more the individual welcomed the idea of being able to travel in a DV. This result arises perhaps from presumptions by people who experience high levels of driving phobia that the drivers of conventional vehicles are unreliable.

'Reasons against using DVs' failed to explain, or be explained by, the variables shown in Figure 1. Within the AMP, moreover, only the positive images and positive words in the primes significantly influenced willingness to travel. It seems that most of the participants cognitively absorbed the positive images and the positive phrases used to describe DVs and carried traces of the positive affect forward to their evaluations of the targets. Conversely, cognitive barriers seem to have prevented many of the sample members from willingly acknowledging the negative images (horrifying crashes, etc.) associated with DVs. This could be due to mental discomfort (possibly caused by high affect intensity or

inherent negativity bias) and hence the shutting down of thoughts about the issue. Apparently, the pleasurable primes were processed in ways different to the processing of the negative primes. The former aroused positive valence, but the latter had no effect. This finding is not in accord with past studies that typically found that primes which elicited positive affect led to favourable evaluations of targets, *and vice versa* (see Blaison et al. [2012] for examples of relevant literature). However, as Blaison et al. (2012) pointed out, 'the mechanisms underlying the AMP remain unclear' (p.404). A possible explanation for the anomalous finding is the suggestion of Clore and Huntsinger (2007) that 'incoming information is related to what is already known and believed', and that 'positive affect tends to reinforce this tendency - - - whereas negative affect tends to inhibit this tendency' (p. 394). Negative (adverse or threatening) events evoke strong and rapid physiological, cognitive, emotional, and behavioural responses that damp down, minimise, and even erase the impact of the events in question (Taylor, 2001). This pattern of mobilisation-minimisation appears to be greater for negative events than for neutral or positive events.

Contributions to Theory and Practice

Practical implications

Outcomes to the present study confirm that implicit attitudes relating to DVs certainly did exist among the sample of non-drivers and that these implicit attitudes were strongly favourable towards DVs. This implies that manufacturers and government agencies should repeatedly transmit positive messages about DVs to non-drivers but that there is possibly little need to develop campaigns refuting the negative features of DVs. Thus, messages should avoid emphasizing problems and instead reassure and remind people of the positives of no stress, easy parking, and the door to door experience (comparable to a taxi service but without a human driver).

Manufacturers advertise their new vehicles, but purchase or hire usually goes through a dealer. Thus, manufacturers will need to apprise their dealers of the selling points of DVs where non-drivers are concerned. Dealers can then mount their own promotions based on appropriate messages. It is important for dealers to realise that non-drivers are *not* a homogeneous group of potential buyers and that substantial market segmentation must be applied. The findings of the present study regarding the DV preferences of non-drivers are relevant also for transport infrastructure managers and for policy makers, given the probability that many current non-drivers will take to the roads with the advent of DCs, causing potential problems for infrastructure and the country's sustainability agenda. State agencies dealing with these matters might need to communicate with new users of road systems and networks. Although DVs will mostly be electric, additional vehicles on the roads might still be a cause for environmental concern. Possible connections between non-drivers' take-up of DVs and future investments in public transport is also a matter of interest to policy makers. Demand for public transport could fall in some geographical areas as non-driving users of public transport switch to buying or hiring DVs. Private ride-sharing may also increase whereby, rather than each individual buying or leasing a new DV, the vehicles will operate more at the fleet level where rides and journeys are shared by people, sharing and splitting the cost of travel. Non-drivers unable to afford their own DV might be attracted to this proposition. Journey sharing could moreover have environmental protection benefits.

The results also have implications for manufacturers' DV design and promotion procedures. Many current non-drivers are people with disabilities or severe driving-related phobias. Hence, health professionals should be included in early discussions regarding infrastructure/product adaptations to cater for people with disabilities and the public promotional campaigns needed to catch their attention. The increased independence afforded to those who at present cannot get around alone will find DVs to be especially useful, and

will help these individuals with issues to do with social isolation and loneliness (see Holt-Lunstad et al, 2015).

Contributions to Theory

Figure 1 offers a fresh configuration of the drivers of willingness to travel in a driverless vehicle, bringing together elements of the theory of reasoned action with core aspects of behaviour reasoning theory. Relations between beliefs and values on the one hand, and implicit and explicit attitudes on the other, were confirmed. The study linked a completely new product (DVs) to a totally fresh potential market for the product (non-drivers). It extended behavioural reasoning theory to the transport marketing domain and employed an attitude measurement technique (AMP) rarely used in consumer research. Two variables not previously included in studies of willingness to travel in DVs (cognitive lock-in and driving/travelling phobia) were incorporated into the model, tested, and found to exert significant influences. The BRT proposition that reasons in favour of a product are not the direct opposites of reasons against was corroborated. BRT incorporates the idea that people's reasons can theoretically impact motivational processes. Outcomes to the present study are compatible with this theory of behaviour. The basic tenet of misattribution theory, that arousal from one situation or event can affect a person's response to an entirely different event, is also substantiated.

The study demonstrates the crucial importance of measuring implicit as well as explicit attitudes in order to access people's deep-rooted opinions which individuals themselves may not know exist. This is important for the creation and marketing of a truly innovative product where people have no experience of the product and cannot know for sure what they think or feel about the product prior to using it. Explicit and implicit measures

combined can provide more robust marketing decision-making and secure knowledge about consumers' views of the new product and which promotional messages to employ.

Limitations and Areas for Future Research

An issue with the AMP is that participants' responses necessarily relate only to the primes actually shown to them. Each prime could possess its own unique characteristics and arousal level which make the results unique to the prime in question. However, the prime might not truly represent the issue under investigation. The present research and most other AMP studies have attempted to mitigate this potentiality by thoroughly pre-testing the relevance of the primes employed in order to ensure that they properly reflect the research questions under examination. In the current study, misattribution definitely occurred for both the positive primes, and the non-significant outcomes applied to both of the negative primes. This provides assurance that the results related to the issue investigated and not simply to irrelevant features of any specific prime. A further possible limitation is that the scales measuring responses to the AMP targets contained just four options, although this was in line with previous literature in the area and was intended to avoid cognitive overload among the participants. Continuous option scales or scales that had (say) ten categories might have captured greater variation in the responses.

Commercially purchased panel data was used in the study. Nevertheless, given the extensive data cleansing activities of the commercial research company that gathered the data, the sample would have been carefully selected to be as representative of UK non-drivers as possible. Nevertheless, the danger of Hawthorne effects among panel members remains (i.e., distorted answers provided by participants simply because they knew that they were part of an experiment). The sample size was as large as permitted by the budget for the investigation, but a larger sample would have been beneficial. It was not possible to control

for the moods of the participants as they completed the questionnaire, although there were no discernible reasons as to why the sample members should have been in a good or bad mood. It is relevant to note that the sample could include some individuals with characteristics that prevented them from driving regardless of their opinions, e.g., residing in locations with strong public transport options, or living in places with no parking spaces. Separate studies might examine in depth these particular market segments.

Replications of the study employing other imagery in primes and targets would be valuable, especially considering that affect misattribution studies have been rare in the management and marketing areas. The absence of published marketing research studies using AMP methodologies means that there are no benchmarks against which to compare the outcomes to the present investigation. Without doubt, the present investigation confirmed the existence and importance of implicit attitudes relating to DVs, yet it was not possible to identify and explore different *types* of attitude. Academic research into attitude formation has been extensive and has proposed numerous attitude typologies. Future research could explore the natures and characteristics of disparate forms of implicit attitudes towards DVs. The consequences of cognitive-lock in also merit further investigation. Breaking a person's deeply held transportation habits is difficult. How can industry make the transition as easy as possible, especially among people who are set in their ways?

The present study involved a 'really new product' currently unavailable to the public. It would be interesting, using AMP, to assess implicit attitudes vis-à-vis other really new and untried futuristic products. A useful piece of research would be to compare the results from a study of a really new product (in addition to DVs) using AMP, IAT, and/or other measures of implicit attitudes.

End Notes

1. At the time of writing, no figures were available on the percentage of UK licence holders who do not drive, although a survey of Scottish licence holders put this figure at 12% (Scottish Government, 2000). The main categories of Scottish non-driving licence holders were individuals under 21 or over 70 years of age; females; single parents; and people with low incomes. Other factors inducing licence holders not to drive were ill health and the ready availability of public transport. A further consideration relating specifically to males might be the idea (encouraged by media advertisements) that driving is exciting, sexy and manly; so that the image of a man without a driving licence is socially unattractive (Woods, 2019). Hence, some men may obtain a licence even though they do not subsequently use it.

2. Blaison et al. (2012) reported 160 AMP studies completed in the six years following the publication of Payne et al's (2005) article. The only use of the AMP in empirical marketing research known to the authors is a study by Baron, Zaltman and Olson (2017), which demonstrated the application of AMP to the marketing of Pepsi Cola. A review article of Dimofte (2010) observed that whilst the AMP (and other implicit measures) were in their infancy within the marketing domain, implicit measures such as AMP showed significant promise as methodological tools for employment in marketing research.

3. Payne and his colleagues used characters from the Chinese language (e.g., 我) in their early investigations, on the assumption that Chinese letters would be meaningless to participants.

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Appendix: The Questionnaire

General

How often do you use transportation – daily; 3 or 4 times a week; once a week; once every 2 weeks/3 weeks/four weeks/less than once a month?

What is your location (city or town centre; city or town suburb; rural area)?

Do you have a full driving licence?

Gender: male/female.

Age (17-22; 23-28; 29-34; etc. up to '75 and above').

Income category: Household income is regarded as (i) higher than that of most other people; (b) about the same as most other people; (c) lower than that of most other people.

Do you have a post-school qualification (post-graduate; degree/post-school diploma; professional qualification; matriculation qualification; none of the above)?

How do you usually travel (six-point scale: All the time, very often, occasionally, very occasionally, hardly ever, never)? I drive, I get lifts from family/friends; I get taxis; I use public transport; I walk; I cycle?

So far in my life I have had the following number of accidents involving motor vehicles: zero; 1;2;3;4; more than 4.

All items other than factual queries above were scored using five-point agree/disagree scales.

Beliefs and values relating to new technology (Cronbach's alpha [α] = 0.87; leading factor [λ] explained 71.85 % of total variance). Literature sources: Karahanna (2006), Schwartz (2006) and O'Driscoll et al. (2013).

(a) Accepting new technologies is very much in line with my personal values

(b) Accepting completely new technologies is consistent with the way I think

(c) Acceptance of automation and new technologies is consistent with how I believe we should all live

(d) Becoming involved with new technologies is part of 'who I am'

(e) My instincts tell me that new technologies lead to a better world

(f) My belief and trust in new technologies is part of how I see myself

Reasons in favour of using DVs. Formative construct. Literature source: Authors (20XX).

(a) DVs are helpful and convenient

(b) Travellers can entertain themselves during journeys (read, watch TV, play games, etc.)

(c) There will be fewer car crashes once all vehicles on the roads are driverless

(d) DVs are at the cutting edge of new technology

(e) Travelling in DVs will be pleasant and enjoyable

Reasons against using DVs. Formative construct. Literature source: Authors (20XX).

(a) It will be very dangerous while DVs are sharing roads with conventional vehicles

(b) Technical failures are likely (breakdowns, software problems, GPS failures, etc.)

(c) DVs will be too expensive for me to buy or lease

(d) The roads and transportation infrastructure are not ready for DVs

(e) A traveller will have no control over a driverless vehicle

Explicit attitudes ($\alpha = 0.89$; $\lambda = 76.12$ %). Literature sources: Ajzen, 2006; Francis et al., 2004.

(a) DVs are an important innovation

(b) DVs are a necessary innovation

(c) DVs are not at all desirable

(d) DVs will not be beneficial to anyone

(e) DVs are a good rather than a bad innovation

Implicit attitudes (Inquisit software [Millisecond Software, LLC])

Measured using an Affect Misattribution Procedure with Tibetan letters as targets. Participants evaluated the targets via a four-point scale (very unpleasant, unpleasant, pleasant, unpleasant, with the order of appearance randomly reversed) consequent to exposure to a prime (see text for details).

Internal locus of control (Pearlin Mastery Scale) ($\alpha = 0.77$; $\lambda = 68.55$ %). Literature source: Pearlin & Schooler, 1978).

(a) There is really no way I can solve some of the problems I have

(b) I often feel that I am being pushed around in life

(c) I have little control over the things that happen to me

(d) I can do just about anything I really set my mind to

(e) I often feel really helpless in dealing with the problems of life

(f) What happens to me in the future mostly depends on me.

(g) There is little I can do to change many of the important things in my life

Desire for independence ($\alpha = 0.83$; $\lambda = 75.50$ %). Literature source: Nagurney et al. (2004).

(a) It is very important for me to retain my independence

(b) It is very important for me to work through my problems by myself

(c) I enjoy being taken care of by others

(d) I don't like having to tackle my problems on my own

Cognitive-lock in. Formative construct. Literature sources: Shih (2012) and Labrecque, Wood, Neal and Harrington (2017).

(a) My current mode of transport provides personal benefits that I cannot easily obtain from other modes of transport

(b) My current mode of transport provides *superior* personal benefits that I cannot easily find from other modes of transport

(c) Driverless vehicles will be difficult to learn how to use

(d) I don't think I will ever really learn how to use a driverless vehicle

Willingness to travel in a DV (α = 0.82; λ = 73.91 %). Literature source: Konig and Neumayr (2017).

(a) I would be willing to travel in a DV

(b) I would not want to travel in a DV on a daily basis

(c) I would be delighted to travel in a DV

(d) The prospect of travelling in a DV does not appeal to me at all

Prior knowledge of DVs (α = 0 .85; λ = 77.91 %). Literature sources: Park and Lessig (1981) and Konig and Neumayr (2017).

(a) I am largely ignorant of DVs

(b) I have not read or seen much information about DVs

(c) I am not at all familiar with how DVs will affect my transport activity

Driving and/or travelling phobia (α = 0.91; λ = 74.06 %). Literature source: APA (2017).

When driving (if you have a licence), or if you don't drive but are travelling in a car or in public transport, to what extent do you agree or disagree with each of the following statements?

(a) I have moments of fear or fright while travelling

(b) I sometimes feel anxious, worried or nervous

(c) I have disturbing thoughts about being injured or killed in a road accident

(d) I sometimes feel shaky, faint, out of breath, and/or have a racing heart

(e) I have disturbing thoughts about being trapped in a vehicle

References

Acheampong, R. & Cugrullo, F. (2019). Capturing the behavioural determinants behind the adoption of driverless vehicles: Conceptual frameworks and measurement models to predict public transport sharing and ownership trends of self-driving cars. *Transportation Research (F): Traffic Psychology and Behaviour*, 62, 349-375.

Adnan, N., Nordin, S., Bahruddin, A. & Ali, M. (2018). How trust can drive forward the user acceptance to the technology? In-vehicle technology for autonomous vehicle. *Transportation Research (A): Policy and Practice,* 118, 819-836.

Ajzen, I. (1991). Nature and operation of attitudes. *Annual Review of Psychology*, 52, 27-58.

Ajzen, I. (1985). From intentions to actions: A theory of planned behaviour. In J. Kuhl & J. Beckman (Eds), *Action Control: From Cognitions to Behaviour* (pp. 11-39). New York, Springer-Verlag.

Ajzen, I. (2006). *Constructing a TpB Questionnaire: Conceptual and Methodological Considerations*. Retrieved 8 November 2019, from https://pdfs.semanticscholar.org/0574/b20bd58130dd5a961f1a2db10fd1fcbae95d.

Ajzen, I. (2012). Martin Fishbein's legacy: The reasoned action approach". *The Annals of the American Academy of Political and Social Science,* 640, 11–27.

Alessandrini, A., Campagna, A. Site, P., Filippi, F. & Persia, L. (2015). Automated vehicles and the rethinking of mobility and cities. *Transportation Research Procedia*, 5, 145-160.

Anania, E., Rice, S., Walters, N., Pierce, M., Winter, S. & Milner. M. (2018). The effects of positive and negative information on consumers' willingness to ride in a driverless vehicle. *Transport Policy*, 72, 218-224.

Anderson, M. & Perrin, A. (2017). *Tech Adoption Climbs Among Older Adults*. Washington DC, Pew Research Centre.

APA (American Psychiatric Association) (2017). *Severity Measure for Specific Phobia*. Washington DC, American Psychological Association. Retrieved 9 November 2019, from file:///C:/Users/ku62587/Downloads/APA_DSM5_Severity-Measure-For-Specific-Phobia-Adult.pdf.

Bagozzi, R., Bergami, M. & Leone, L. (2003). Hierarchical representation of motives in goal setting. *Journal of Applied Psychology*, 88, 915-943.

Baron, A., Zaltman, G. & Olson, J. (2017). Barriers to advancing the science and practice of marketing. *Journal of Marketing Management*, 33(11/12), 893-908.

Belletier, C., Robert, A., Moták, L. & Izaute, M. (2018). Toward explicit measures of intention to predict information system use: An exploratory study of the role of implicit attitudes. *Computers in Human Behaviour*, 86, 61-68.

Bennett, R., Vijaygopal, R. & Kottasz, R. (2019a). Willingness of people with mental disabilities to travel in driverless vehicles. *Journal of Transport and Health,* 12 (January), 1-12.

Bennett, R., Vijaygopal, R. & Kottasz, R. (2019b). Attitudes towards driverless vehicles among people with physical disabilities. *Transportation Research (A): Policy and Practice,* 127, 1-17.

Bergman, M. (1988). A theoretical note on the differences between attitudes, opinions and values. *Swiss Political Science Review*, 4(2), 81-93.

Blaison, C., Imhoff, R., Huhnel, I., Hess, U. & Banse, R. (2012). The affect misattribution procedure: Hot or not? *Emotion*, 12(2), 403-412.

Burroughs, J. & Glen Mick, D. (2004). Exploring antecedents and consequences of consumer creativity in a problem-solving context. *Journal of Consumer Research*, 31(2), 402-411.

Calvert, G., Fulcher, E., Fulcher, G., Foster, P. & Rose, H. (2014). Using implicit methods to develop an objective measure of media brand engagement. *International Journal of Market Research*, 56(1), 15-32.

Charness, N., Yoon, J., Souders, D., Stothart, C. & Yehnert, C. (2018). Predictors of attitudes towards driverless vehicles: The roles of age, prior knowledge, and personality. *Frontiers in Psychology: Cognitive Science*, 9: 2589.

Chazidakis, A. & Lee, M. (2012). Anti-Consumption as the study of reasons against. *Journal of Macromarketing*, 33(3), 1-14.

Cheron, E. & Hayashi, H. (2001). The effects of respondents' nationality and familiarity with a product category on the importance of product attributes in consumer choice. *Journal of Psychological Research*, 43(4), 183-194.

Choi, J. & Ji, Y. (2015). Investigating the importance of trust in adopting an autonomous vehicle. *International Journal of Human-Computer Interaction*, 31(10), 692-702.

Claudy, M., Garcia, R. & O'Driscoll, A. (2015). Consumer resistance to innovation: A behavioural reasoning perspective. *Journal of the Academy of Marketing Science*, 43(4), 528-544.

Claudy, M., Peterson, M. & O'Driscoll, A. (2013). Understanding the attitude-behaviour gap for renewable energy systems using behavioural reasoning theory. *Journal of Macromarketing,* 33(4), 273-287.

Clore, G. & Huntsinger, J. (2007). How emotions inform judgment and regulate thought, *Trends in Cognitive Science*, 11(9), 393-399.

Cohen, S. & Hopkins, D. (2019). Driverless vehicles and the future of urban tourism. *Annals of Tourism Research*, 74, 33-42.

Curl, A. & Fitt, H. (2019). Will driverless cars be good for us? Now is the time for public health to act together with urban and transport planning. *Journal of Global Health*, 9(2), 020303.

Cymbala, A. & Owczarczuk, M. (2011). Variables importance on questionnaire data on advertising. *Expert Systems with Applications,* 38, 14218-14224.

D'Costa, K (2013). Choice, freedom and car ownership. *Scientific American*, 22 April 2013. Retrieved 28 October 2019, from www.scientificamerican.com/anthropology-in-practice.

Da Costa, R., Carvalho, M., Cantini, J., Friere, R. & Nardi, A. (2014). Demographics, clinical characteristics and quality of life of Brazilian women with driving phobia. *Comprehensive Psychology*, 55, 374-379.

Davos, T. (2008). *Attitudes and Attitude Change*. New York, Psychology Press.

Deutsch, R. & Gawronski, B. (2009). When the method makes a difference: Antagonistic effects on 'automatic evaluations' as a function of task characteristics of the measure. *Journal of Experimental Social Psychology*, 45, 101-114.

Dimofte, C. (2010). Implicit measures of consumer recognition: A review. *Psychology and Marketing*, 27(10), 921-937.

Donnelly, C., Galandarova, A., Porter, K., Singaravelan, S. & Retboll, E. (2016). *Autonomous Vehicle and Sempra Energy*. San Diego, University of San Diego.

Eagly, A. & Chaiken, S. (2007). The advantages of an inclusive definition of attitude. *Social Cognition*, 25(2), 582-602.

Ecker, Y., & Bar-Anan, Y. (2015). *Testing the AMP*. Retrieved 23 November 2019, from osf.io/pyzrv.

Eder, A. & Deutsch, R. (2015). Watch the target! Effects in the affective misattribution procedure become weaker (but not eliminated) when participants are motivated to provide accurate responses to the target. *Frontiers in Psychology*, 6, 01442.

Egbue, O. & Long, S. (2012). Barriers to widespread adoption of electric vehicles: An analysis of consumer attitudes and perceptions. *Energy Policy*, 48, 717-729.

Ehlers, A., Hofmann, S., Herda, C. & Roth, W. (1994). Clinical characteristics of driving phobia. *Journal of Anxiety Disorders*, 8, 323-333.

Fazio, R. & Olson, M. (2003). Implicit measures in social cognition research: Their meaning and use. *Annual Review of Psychology*, 54, 297-327.

Fishbein, M. & Ajzen, I. (1975). *Belief, Attitude, Intention, and Behaviour: An Introduction to Theory and Research.* Reading, MA, Addison-Wesley.

Fornell, C. & Larcker, D. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39-50.

Fraedrich, E., Cyganski, R. & Lenz, B. (2015). Travel time valuation for automated driving: A use-case-driven study. *Proceedings of the 94th Meeting of the Transport Research Board*, Washington DC, 1-19.

Fragnant, D. & Kockelman, K. (2015). Preparing a nation for driverless vehicles: Opportunities, barriers and policy recommendations. *Transportation Research (A): Policy and Practice*, 77, 167-181.

Francis, J., Eccles, M., Johnston, M., Walker, A., Grimshaw, J., Foy, R., Kaner, E., Smith, L. & Bonetti, D. (2004). *Constructing Questionnaires Based on the Theory of Planned*

Behaviour: A Manual for Health Services Researchers. Newcastle upon Tyne UK, Centre for Health Services Research, University of Newcastle.

Gawronski, B. & Hahn, A. (2019). Implicit measures: Procedures, use and interpretation. In H. Blanton, J. LaCroix & G. Webster (Eds), *Measurement in Social Psychology* (pp. 29-55). New York, Taylor and Francis.

Greenwald, A. & Banaji, M. (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. *Psychological Review*, 102(1), 4–27.

Greenwald, A., McGhee, D. & Schwartz, J. (1998). Measuring implicit differences in individual cognition: the implicit association test. *Journal of Personality and Social Psychology*, 74(6), 1464-1480.

Gregan-Paxton, J. & Moreau, P. (2003). How do consumers transfer existing knowledge? A comparison of analogy and categorization effects. *Journal of Consumer Psychology*, 13(4), 422-430.

Guerra, E. (2015). Planning for cars that drive themselves: Metropolitan planning organisations, regional transportation plans, and driverless vehicles. *Journal of Planning Education and Research*, 36(2), 210-224.

Gupta, A. & Arora, N. (2017a). Consumer adoption of m-banking: a behavioural reasoning theory perspective. *International Journal of Bank Marketing*, 35(4), 733-47.

Gupta, A. & Arora, N. (2017b). Understanding determinants and barriers of mobile shopping adoption using behavioural reasoning theory. *Journal of Retailing and Consumer Services*, 36, 1-7.

Hair, J., Black, W., Babin, B. and Anderson, J. (2010). *Multivariate Data Analysis*. Seventh Edition, New Jersey, Prentice Hall.

Hair, J., Hult, G., Ringle, C. & Sarsedt, M. (2017). *A Primer on Partial Least Squares Structural Equation Modelling*, Second Edition, Los Angeles, Sage.

Harper, C, Hendrickson, C., Mangones, S. & Samaras, C. (2016). Estimating potential increases in travel with driverless vehicles for the non-driving, elderly and people with travel-restrictive medical conditions. *Transportation Research (C): Emerging Technologies,* 72, 1-9.

Hearn, A. (2018). Nearly a quarter of British drivers feel anxious driving on motorways, study claims. *The Independent*, 22 August 2018. Retrieved 27 July 2020, from https://www.independent.co.uk/extras/lifestyle/british-drivers-anxiety-motorways-multi-lane-highways-a8502581.html.

Henseler, J., Ringle, C. & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modelling. *Journal of the Academy of Marketing Science,* 43(1), 115–135.

Here.com (2017). *Consumer Acceptance of Driverless Vehicles*. Retrieved 15 November 2019, from https://www.here.com/sites/g/files/odxslz166/files/2018-11/Consumer_Acceptance_of_Autonomous_Vehicles_white_paper_1.pdf.

Holt-Lunstad, J., Smith, T., Baker, M., Harris, T. & Stephenson, D. (2015). Loneliness and social isolation as risk factors for mortality: A meta-analytic review. *Perspectives on Psychological Science,* 10, 227-37.

Hsee, C. (1996). Elastic justification: How unjustifiable factors influence judgments. *Organizational Behaviour and Human Decision Processes*, 66, 122-129.

Huang, J. & Ford, J. (2012). Driving locus of control and driving behaviours: Inducing change through driver training. *Transportation Research (F): Traffic Psychology and Behaviour*, 15(3), 358-368.

Johnson, E., Bellman, S. & Lohse, G. (2003). Cognitive lock-in and the power law of practice. *Journal of Marketing*, 67(2), 62-75.

Kanwaldeep, K. & Rampersad, G. (2018). Trust in driverless vehicles: Investigating key factors influencing the adoption of driverless vehicles. *Journal of Engineering and Technology Management,* 48, 87-96.

Karahanna, E. (2006). Reconceptualizing compatibility beliefs in technology acceptance research. *MIS Quarterly*, 30(4), 781-804.

Kelley, S., Lane, B. & DeCicco, M. (2019). Pumping the brakes on robot cars: Current urban traveller willingness to consider driverless vehicles. *Sustainability*, 11, 1-15.

Kencebay, B. (2019). User acceptance of driverless vehicles and robots with aspects of personal economy. *Journal of Transnational Management*, 24(4), 283-304.

Ker, I. & Tranter, P. (1997). A wish called wander: Reclaiming automobility from the motor car. *World Transport Policy and Practice*, 3(2), 10-16.

Khasawneh, O. (2018). Technophobia without boarders: The influence of technophobia and emotional intelligence on technology acceptance and the moderating influence of organizational climate. *Computers in Human Behaviour*, 88, 210-218.

Kim, H., Chan, H.C. & Gupta, S. (2007). Value-based adoption of mobile Internet: An empirical investigation. *Decision Support Systems*, 3(1), 111-126.

Kleijnen, M., Lee, N., & Wetzels, M. (2009). An exploration of consumer resistance to innovation and its antecedents. *Journal of Economic Psychology*, 30, 344–357.

Klemperer, P. (1987). Markets with consumer switching costs. *Quarterly Journal of Economics,* 102(2), 375-394.

Konig, M. & Neumayr, L. (2017). Users' resistance towards radical innovations: The case of the self-driving car. *Traffic Psychology (F): Psychology and Behaviour*, 44, 42-52.

Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin*, 108, 480-498.

Kyriakidis, M., Happee, R. & de Winter, J. (2015). Public opinion on automated driving: Results of an international questionnaire among 5000 respondents. *Transportation Research (F): Traffic Psychology and Behaviour*, 32, 127-140.

Labrecque, J., Wood, W., Neal, D. & Harrington, N. (2017). Habit slips: When consumers unintentionally resist new products. *Journal of the Academy of Marketing Science*, 45(1), 119-133.

Ledesma, R., Tosi, J., Díaz-Lázaro, C. & Poóab, F. (2018). Predicting road safety behaviour with implicit attitudes and the Theory of Planned Behaviour. *Journal of Safety Research*. 66, 187-194.

Lee, J., Lee, D., Park, Y. & Lee, S. (2019). Driverless vehicles can be shared, but a feeling of ownership is important: Examination of the influential factors for intention to use driverless vehicles. *Transportation Research (C), Emerging Technologies*, 107, 411-422.

Lenz, B. & Fraedrich, E. (2014). Automated driving: Individual and societal aspects entering the debate. *Proceedings of the 93rd Meeting of the Transport Research Board*, Washington DC, 64-72.

Liljamo, T., Liimatainen, H. & Pollanen, M. (2018). Attitudes and concerns on automated vehicles. *Transportation Research (F): Traffic Psychology and Behaviour*, 59, 24-44.

Litman, T. (2017). *AV Implementation Predictions: Implications for Transport Planning*. Victoria New South Wales, Victoria Transport Planning Institute.

Lu, J., Yu, C., Liu, C. & Yao, J. (2003). Technology acceptance model for wireless Internet, *Internet Research*, 13(3), 206-222.

McCool, S. (2019). *CAV Public Acceptability Dialogue: Engagement Report*. London, Traverse.

McHugh, C. & Way, J. (2018). What is reasoning? *Mind*, 127(5), 167–196.

Mani, Z. & Chouk, I. (2017). Drivers of consumers' resistance to smart products. *Journal of Marketing Management*, 33(1-2), 76-97.

Mani, Z. & Chouk, I. (2019). Impact of privacy concerns on resistance to smart services: Does the 'Big Brother effect' matter? *Journal of Marketing Management*, 35(15-16), 1460-1479.

Mann, T., Cone, J., Heggeseth, B. & Ferguson, M. (2019). Updating implicit impressions: New evidence on intentionality and the affect misattribution procedure. *Journal of Personality and Social Psychology*, 116(3), 349-374.

Martinussen, L., Sømhovd, M., Møller, M. & Siebler, F. (2015). A Go/No-go approach to uncovering implicit attitudes towards safe and risky driving. *Transportation Research. Part F: Traffic Psychology and Behaviour,* 30, 74-83.

Mazaheri, M., Hidarnia, A. & Ghofranipour, F. (2012). Safety education and control: A tool to measure the safety locus of control. *Journal of Health and Education Promotion*, 1(21), 1-4.

Menon, N. (2017). *Autonomous Vehicles: An Empirical Assessment of Consumers' Perceptions, Intended Adoption, and Impacts on Household Vehicle Ownership.* Graduate

Theses and Dissertations. Retrieved 10 November 2020, from http://scholarcommons.usf.edu/etd/6901.

Michael, T., Kumar, A. & Kumar, S. (2016). A survey of literature on automated transport systems. *International Journal of Engineering Technology Science and Research*, 3(12), 19-25.

Modva, A. (2016). Why important attitudes are (probably) not beliefs. S*ynthese*, 193(8), 2659-2684.

Montarzino, A., Robertson, B., Aspinal, P., Findlay, C., Hine, J. & Dhillon, B. (2007). The impact of mobility and public transport on the independence of visually impaired people. *Visual Impairment Research*, 9(2/3), 67-82.

Moons, I. & De Pelsmacker, P. (2012). Emotions as determinants of electric car usage intention. *Journal of Marketing Management*, 28(3/4), 195-237.

Mulcahy, R., Letheren, K., McAndrew, R., Glavas, C. & Russell-Bennett, R. (2019). Are households ready to engage with smart home technology? *Journal of Marketing Management*, 35(15-16), 1367-1369.

Murphy, S. & Zajonc, R. (1993). Affect, cognition, and awareness: Affective priming with optimal and suboptimal stimulus exposures. *Journal of Personality and Social Psychology,* 64, 723–739.

Murray, L. (2017). Hitch a ride with Harry. *E and T Magazine*. Retrieved 12 August 2020, from https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8392883.

Murray, K. & Häubl, G. (2007). Explaining cognitive lock-in: The role of skill-based habits of use in consumer choice. *Journal of Consumer Research*, 34(1), 77-88.

Nagurney, A., Reich, J. & Newsom, J. (2004). Gender moderates the effects of independence and dependence desires during the social support process. *Psychology and Aging*, 19(1), 215-218.

Nguyen, B. & Simkin, L. (2017). The Internet of Things (IoT) and marketing: The state of play, future trends and the implications for marketing. *Journal of Marketing Management*, 33(1-2), 1-6.

Nordhoff, S., Arem, B. & Happee, R. (2016). Conceptual model to explain, predict, and improve user acceptance of driverless pod like vehicles. *Transportation Research Record,* No. 2602(1), 60-67.

Nordhoff, S., de Winter, J., Kyriakidis, M., Arem, B. & Happee, R. (2018). Acceptance of driverless vehicles: Results from a large cross-national questionnaire study. *Journal of Advanced Transportation,* Vol. 2018, ID 538219, pp. 1-22. Retrieved on 12 August 2020, from https://www.hindawi.com/journals/jat/2018/5382192/.

Nosek, B. (2007). Implicit–explicit relations. *Current Directions in Psychological Science*, 16(2), 65-69.

Nosek, B., Banaji, M. & Greenwald, A. (2002). Harvesting implicit group attitudes and beliefs from a demonstration website. *Group Dynamics: Theory, Research and Practice*, 6(1), 101-115.

Nunnally, J. and Bernstein, I. (1994). *Psychometric Theory*. New York, McGraw-Hill.

O'Driscoll, A., Claudy, M. & Peterson, M. (2013). Understanding the attitude-behaviour gap for renewable energy systems using behavioural reasoning theory. *Journal of Macromarketing,* 33(4), 273-287.

OECD (Organisation for Economic Cooperation and Development) (2017). *Guidelines on the Protection of Privacy and Transborder Flows of Personal Data*. Paris, OECD.

ONS (Office for National statistics) (2019). *Percentage of Households with Cars by Income Group, Tenure & Household Composition: Table A47.* London, ONS.

Papa, E. & Ferreira, A. (2018). Sustainable accessibility and the implementation of driverless vehicles: Identifying critical decisions. *Urban Science*, 21(1), 1-14.

Pennington, N. & Hastie, R. (1988). Explanation-based decision making: Effects of memory structure on judgment. *Journal of Experimental Psychology: Learning, Memory, and Cognition,* 14, 521-533.

Perugini, M. (2005). Predictive models of implicit and explicit attitudes. *British Journal of Social Psychology*, 44, 29-45.

Pieters, R. & Zeelenberg, M. (2005). On bad decisions and deciding badly: When intention-behaviour inconsistency is regrettable. *Organizational Behaviour and Human Decision Processes,* 97, 18-30.

Özkan, T. & Lajunen, T. (2005). Multidimensional traffic locus of control Scale (T-LOC): Factor structure and relationship to risky driving. *Personality and Individual Differences*, 38(3), 533-545.

Park, C. & Lessig, V. (1981). Familiarity and its impact on consumer decision biases and heuristics. *Journal of Consumer Research*, 8(3), 223-230.

Pavlou, P. & Fygenson, M. (2006). Understanding and predicting electronic commerce adoption: An extension of the theory of planned behaviour. *MIS Quarterly*, 30(1), 115-43.

Payne, B., Cheng, C., Govorun, O. & Stewart, B. (2005). An inkblot for attitudes: Affect misattribution as implicit measurement. *Journal of Personality and Social Psychology,* 89(3), 277-293.

Payne, B. & Lundberg, K. (2014). The affect misattribution procedure: Ten years of reliability, validity and mechanisms. *Social and Personality Psychology Compass*, 8(12), 672-686.

Payre, W., Cestac, J. & Delhomme, P. (2014). Intention to use a fully automated car: Attitudes and a-priori acceptability. *Transportation Research Part F: Traffic Psychology and Behaviour,* 27, 252-263.

Pearlin, L. & Schooler, C. (1978). The structure of coping. *Journal of Health and Social Behaviour,* 19(1), 2-21.

Pettigrew, S., Worrall, C., Talati, Z., Fritschi, L. & Norman, R. (2019). Dimensions of attitudes to driverless vehicles. *Urban Planning and Transport Research*, 7(1), 19-33.

Pomerantz, M. (2019). *Some Thoughts on Independence and Blindness*. Alexandra VA, American Council of the Blind.

Potosky, D. & Bobko, P. (2001). A model for predicting computer experience from attitudes toward computers. *Journal of Business and Psychology*, 15(3), 391-404.

RAC Foundation (2019). *Motoring Facts and Figures: Mobility*. London, Royal Automobile Club.

Ratchford, B. (2001). The economics of consumer knowledge. *Journal of Consumer Research*, 27(4), 397-411.

Rezvani, Z., Jansson, J. & Bodin, J. (2015). Advances in consumer vehicle adoption research: A review and research agenda. *Transportation Research Part D: Transport and Environment*, 34, 122-136.

Ringle, C., Wende, S. & Becker, J. (2015). *SmartPLS*., Boenningstedt, SmartPLS GmbH.

Rotter, J. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs: General and Applied*, 80(1), 1-28.

Rusu, A., Sârbescu, P., Moza, D. & Stancu, A. (2017). Implicit attitudes towards risky driving: Development and validation of an affect misattribution procedure for speeding. *Accident Analysis and Prevention*, 100, 15-22.

Ryan, J. & Casidy, R. (2019). The role of brand reputation in organic food consumption: A behavioural reasoning perspective. *Journal of Retailing and Consumer Services,* 41, 239-247.

Sahu, A., Padhy, R. and Dhir, A. (2020). Envisioning the future of behavioural decision-making: A systematic literature review of behavioural reasoning theory. *Australasian Marketing Journal*, 28(4), 145-159.

Sanbonmatsu, D., Strayer, D., Yu, Z., Biondi, F. & Cooper, J. (2018). Cognitive underpinnings of beliefs and confidence in beliefs about fully automated vehicles. Transportation *Research Part F: Traffic Psychology and Behaviour*, 55, 114-122.

Schaller, T., Patil, A. & Malhotra, N. (2015). Alternative techniques for assessing common method variance: An analysis of the Theory of Planned Behaviour research. *Organizational Research Methods,* 18, 177-206.

Schreier, M. & Prügl, R. (2008). Extending lead-user theory: Antecedents and consequences of consumers' lead userness. *Journal of Product Innovation Management*, 25(4), 331-346.

Schwartz, S. (2006). Basic human values: An overview. *Applied Psychology,* 48(1), 49-71.

Scottish Government (2000). *Why People Don't Drive Cars*. Edinburgh, Scottish Executive Central Research Unit.

Shapiro, C. & Varian, H. (1999). The art of standards wars. *California Management Review*, 41(2), 8-32.

Sheth, J. (1981). Psychology of innovation resistance: The less developed concept (LDC) in diffusion research. *Research in Marketing*, 4, 273–282.

Shih, H. (2012). Cognitive lock-in effects on consumer purchase intentions in the context of B 2 C web sites. *Psychology & Marketing*. 29(10), 738-751.

Sivathanu, B. (2018). Adoption of internet of things (IOT) based wearables for healthcare of older adults: A behavioural reasoning theory (BRT) approach. *Journal of Enabling Technologies*, 12(4), 169-185.

Smith, B. (2014). A legal perspective on three misconceptions in vehicle automation. In G. Meyer & S. Beiker (Eds), *Road Vehicle Automation* (pp. 85-91). Geneva, Springer.

Smith, A. & Anderson, M. (2017). *Automation in Everyday Life*. Washington DC, Pew Research Centre.

Smolnicki, P. (2017). Connected and automated urban mobility: Zombie cars and kitchen knives. *Proceedings of the 53rd OAPA/ISOCARP Conference*, Portland Oregon, International Society of City and Regional Planners, pp. 1-11.

Smolnicki, P. (2018). State of the art of automated buses. *Sustainability*, 10(9), 1-34.

Smolnicki, P. & Soltys, J. (2016). Driverless mobility: The impact on metropolitan spatial structures. *Procedia Engineering*, 161, 2184-2190.

Sundar, S. & Jimirro, J. (2019). Believing machines can out-do people may fuel acceptance of self-driving cars. *ACM CHI Conference on Human Factors* (66-75). Glasgow, Association for Computer Machinery.

Taylor, S. (1991). Asymmetrical effects of positive and negative events: The mobilization-minimization hypothesis. *Psychological Bulletin*, 110(1), 67-85.

Taylor, J., Alpass, F., Stephens, C. & Towers, A. (2011). Driving anxiety and fear in younger older adults in New Zealand. *Age and Ageing*, 40(1), 62-66.

Taylor, J., Deane, F. & Podd, J. (2000). Determining the focus of driving fears. *Journal of Anxiety Disorders,* 14(5), 453-470.

Taylor, J. & Sullman, M. (2009). What does the driving and riding avoidance scale (DRAS) measure? *Journal of Anxiety Disorders*, 23, 504-510.

Wadud, Z. MacKenzie, D. & Leiby, P. (2016). Help or hindrance? The travel, energy and carbon impacts of highly automated vehicles. *Transport. Research Part A: Policy and Practice,* 86, 1-18.

Wald, J. & Taylor, S. (2000). Efficacy of virtual reality exposure therapy to treat driving phobia: A case report. *Journal of Behaviour Therapy and Experimental Psychiatry*, 31, 249-257.

Weinberger, M. & Lepkowska-White, E. (2000). The influence of negative information on purchase behaviour. *Journal of Marketing Management*, 16(5), 465-481.

West, D. (2016). *Moving Forward: Self-driving Vehicles in China, Europe, Japan, Korea, and the United States.* Washington DC, Brookings Centre for Technology Innovation.

Westaby, J. (2005). Behavioural reasoning theory: Identifying new linkages underlying intentions and behaviour. *Organisational Behaviour and Human Decision Processes,* 98, 97-120.

H1by, J., Probst, M. & Lee, B. (2010). Leadership decision-making: A behavioural reasoning theory analysis. *The Leadership Quarterly,* 21(3), 481-495.

Woods, A. (2019). I'm a non-driver: Does that make me less of a man? *The Telegraph*, 20 November 2019. Retrieved 10 July 2020, from www.telegraph.co.uk.

Wyer, R. (2008). The role of knowledge accessibility in cognition and behaviour: Implications for consumer information processing. In C. Haugtvedt, P. Herr & F. Kardes (Eds.), *Handbook of Consumer Psychology* (pp. 31-76). New York, Taylor & Francis.

Xu, Z., Zhang, K., Min, H., Wang, Z., Zhao, X. & Liu, P. (2018). What drives people to accept automated vehicles: Findings from a field experiment. *Transportation Research Part C: Emerging Technologies,* 95, 320- 334.

Zauberman, G. (2003). The intertemporal dynamics of consumer lock-in. *Journal of Consumer Research,* 30, 405–419.

Zimmermann, A. (2007). The nature of belief. *Journal of Consciousness Studies*, 14(11), 61-82.

Znanewitz, J., Braun, L., Hensel, D., Altobelli, C. & Hattke, F. (2018). A critical comparison of selected implicit measurement methods. *Journal of Neuroscience, Psychology, and Economics*, 11(4), 249-65.