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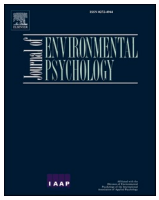

Resistance to purchasing all-electric vehicles: Evidence from a national survey

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ABSTRACT

Most Americans believe that climate change, if unchecked, will be a serious problem, but a majority are not willing to even consider purchasing all-electric vehicles (EVs). This paper is the first to report an in-depth test of hypotheses to explain this resistance, derived from a conceptual framework built upon rational choice theory, theories of morality, the Theory of Reasoned Action, the Theory of Planned Behavior, the Technology Acceptance Model, and Mere Exposure Theory. Data from a 2020 survey of a nationally representative sample of the American adult population (N = 502) showed: as expected, financial and non-financial instrumental considerations and normative considerations were strong predictors of resistance, whereas first-hand or second-hand experience driving an EV did not predict resistance. Experience with EVs and educational attainment moderated the impact of some predictors of resistance. These findings testify to the value of the conceptual framework, validate some predictions while refuting others, and identify pathways to encouraging more EV adoption.

1. Introduction

According to many national surveys, the majority of Americans have believed for decades that the earth has been warming over the last 100 years, that this warming will continue if unaddressed, and that if unchecked, it will constitute a nationally and globally serious problem. Furthermore, most people have believed that governments, businesses, and individuals should take steps to attenuate warming and its likely consequences (see Krosnick & MacInnis, 2020 for a review of national surveys).

Some natural scientists and economists have proposed reducing CO_2 emissions through widespread adoption of all-electric vehicles (EVs) powered by electricity generated from sunlight, wind, and water. According to the U.S. Environmental Protection Agency (EPA, 2020), the transportation sector emits more greenhouse gases than any other sector in the U.S. due to near-complete dependence on fossil fuels. The largest component of emissions, light-duty vehicles such as cars, constitute 59% of the transportation sector and are responsible for 17% of total U.S. greenhouse gas emissions. Like other components of the transportation sector, cars are primarily gasoline powered. Therefore, emissions can be dramatically reduced by a widespread shift from carbon-intensive transportation to EVs as long as the electricity is made from other sources.

If the American public is aware of this and if the public favors the reduction of greenhouse gas emissions, it might be positively inclined toward purchasing such vehicles. And such a positive inclination might seem likely because, during the 2020 U.S. presidential election campaign, both Donald Trump and Joe Biden expressed support for government efforts to promote the use of EVs. For example, during their first debate on September 29, 2020, both candidates said they favored enhanced use of electric vehicles. Mr. Biden pledged to build 500,000 charging stations along highways, to increase the proportion of federally owned and operated vehicles that are all-electric, and to provide tax credits to incentivize consumer purchases of EVs (Biden, 2020). And during that same debate, Mr. Trump expressed his support for EVs as well: "I'm OK with electric cars, too. I'm all for electric cars. I've given big incentives for electric cars" (Kolodny, 2020). This bipartisan endorsement of EVs might provide a basis for expecting widespread public interest in purchasing EVs.

Consistent with this reasoning, the manufacturing of all-electric cars has been increasing in recent years (Riley, 2019). Many automobile manufacturers in the U.S. and around the world have committed to

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increasing production of all-electric vehicles via vast capital investment and restructuring the manufacturing process (Eisenstein, 2019; Foldy, 2020a). Some observers have proclaimed that this trend will continue in the coming decades, with some analysts projecting that by 2040, EVs could outsell gasoline- and diesel-powered vehicles (Riley, 2019).

Yet sales of EVs thus far represent only a small share of consumer automobile purchases in the U.S. As of September 2019, more than 1.3 million EVs were on U.S. roads, and new EV sales represented only 2.6% of all new car sales (EEI, 2019). Of the 6.6 million EVs sold in 2021, 3.3 million were sold in China, 2.3 million were sold in Europe, and only 630,000 were sold in the United States (International Energy Agency, 2022). From the perspective of innovation diffusion theory, adoption of EVs appears to be in its "early adopters" phase (Rogers, 2003). Scholars, business leaders, and policymakers have therefore been interested in understanding why American consumers have been slower to adopt this technology than consumers in China and Europe (Desilver, 2021).

According to well-established theories in social psychology, such as the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975) and the Theory of Planned Behavior (TPB) (Ajzen, 1985, 1991), purchasing an EV is most likely the result of an intention to make such a purchase. That is, a person is most likely to perform a behavior if that person says he or she intends to perform it. Intentions have been studied extensively in many disciplines.[1] And according to the TRA and the TPB, intentions are formulated as the result of a cognitively intensive analysis of costs, benefits, and normative desires of significant others. But before implementing that analysis, an individual must presumably decide that he or she is willing to consider performing that behavior.

For example, when setting out to purchase a vehicle for personal transportation, a potential buyer must first decide what sorts of vehicles he or she is willing to consider. A sedan? An SUV? A station wagon? A van? A truck? A gasoline-powered vehicle? An EV? Answers to all of these questions then presumably guide the potential buyer's decisions about what dealers to visit and what vehicles to test-drive at those dealerships. Finally, after experiencing vehicles in the individual's choice set in this way, the potential buyer formulates an intention to buy one of the types of vehicles and engages in negotiating prices with dealers, leading ultimately to acquisition. Thus, in this scenario, "willingness to consider" decisions are choices made before dealer visits, and intention to purchase is a choice formulated after dealer visits. Thus, "willingness to consider" performing a behavior is a necessary precondition to formulating the intention to perform that behavior.

We have found no prior research exploring the determinants of this gateway precursor in the context of EVs. Instead, some past studies have explored the causes of actual purchasing of EVs. For example, Nayum and Klockner (2014) found that purchasing an EV was caused by intention to buy a fuel-efficient car, weak loyalty to the brands of gas-powered vehicles, living in a household with more cars and fewer driver's licenses, larger household size, and lower household income. Jansson, Nordlund, and Westin (2017) found that EV purchasing was more likely among people scoring higher on personal norms endorsing owning an environmentally friendly car and feeling a moral obligation to reduce the negative aspect of driving, as well as the beliefs that (1) society is approaching the limit of the size of the population the earth can support, (2) a major ecological catastrophe is likely if things continue on their present course, (3) the balance of nature is very delicate and easily upset, and (4) humans interfering with nature causes disastrous consequences. Priessner, Sposato, and Hampl (2018) found EV adoption was more likely among people who held pro-environmental attitudes (e.g., "I would say of myself that I am environmentally conscious."), pro-technological attitudes (e.g., "I see the digitization as an opportunity for better networking."), and less individualistic worldviews, as well as being female and having more cars in the household.

Other past studies have identified predictors of the intention to purchase an EV. For example, Barbarossa, Beckmann, De Pelsmacker, Moons, and Gwozdz (2015) found that green self-identity was a primary motivator of caring about the environment and green moral obligation, which enhanced intention to purchase EVs. Schmalfuss, Muhl, and Krems (2017) found that beliefs about the environmental effects of EVs (e.g., use of EVs contributes to a reduction of environmental problems), economic attributes of EVs (e.g., a person can save money by using an EV), and practical aspects of charging EVs (e.g., charging time is not problematic) predicted the intention to purchase an EV. In addition, subjective norms (e.g., "People who are important to me would support me if I buy an EV."[2]) and perceived behavioral control (e.g., "It would be impossible for me to purchase an EV in the near future.") were positively related to EV purchase intent, and being male was negatively associated with EV purchase intent. Thogersen and Ebsen (2019) found that favorable attitudes towards buying an EV, personal norms that buying/owning an environmentally friendly car is morally right, perceived ease of use of EVs, and greater knowledge about EVs positively predicted intention to purchase an EV.

The present manuscript complements these past studies by focusing instead on the gateway precondition necessary for intention to purchase and actual purchasing: willingness to consider purchasing an EV. The paper proposes a conceptual framework inspired by rational choice theory (from economics), moral theories of pro-environmental behavior from social psychology, as well as the TRA, the TPB, the Technology Acceptance Model (TAM), and Mere Exposure Theory. The conceptual framework yields an array of hypotheses about factors that might explain resistance to buying EVs. This investigation is not a competition among the theories, nor is it an effort to test all hypotheses that might be derived from the full array of theories. Rather, the empirical testing described below is meant to evaluate the validity of some elements of the conceptual framework. The net result, we hope, is a step toward building a comprehensive theory of resistance to purchasing EVs.

The conceptual framework proposes that three categories of considerations may influence people's resistance to purchasing EVs: instrumental considerations, normative considerations, and experience. Instrumental considerations include both financial ones and non-financial ones. Financial instrumental considerations include the monetary costs of purchasing and using an EV, such as purchase price, maintenance cost, and operating cost. Non-financial instrumental considerations include the performance and safety of an EV. Normative considerations include awareness of the seriousness of the environmental problems that non-EVs create and awareness of the consequences of one's action in addressing those problems by adopting EVs. The conceptual framework also proposes that first-hand or second-hand experience with EVs might influence resistance to EV purchasing. Lastly, the framework proposes possible moderators that might regulate the impact of these various considerations on resistance to EV adoption.

Below, we present the conceptual framework, offer a brief review of the theories from psychology, economics, and technology innovations from which the framework is derived, and propose hypotheses derived from the framework. Then we describe the data collected to test those hypotheses, the analytical methods employed in this investigation, the obtained results, and their implications for theory and practice.

2. The conceptual framework

This conceptual framework proposes three categories of factors influencing willingness to consider purchasing EVs (instrumental considerations, normative considerations, and experience) (Fig. 1). In this

[1] Google Scholar searches conducted on June 28, 2023, showed that the term "intention to vote" was used in over 1.8 million publications, and "intention to quit smoking" was used in 144,000 publications.

[2] The investigators used the term BEV, which stands for battery electric vehicle. We shortened it to EV.

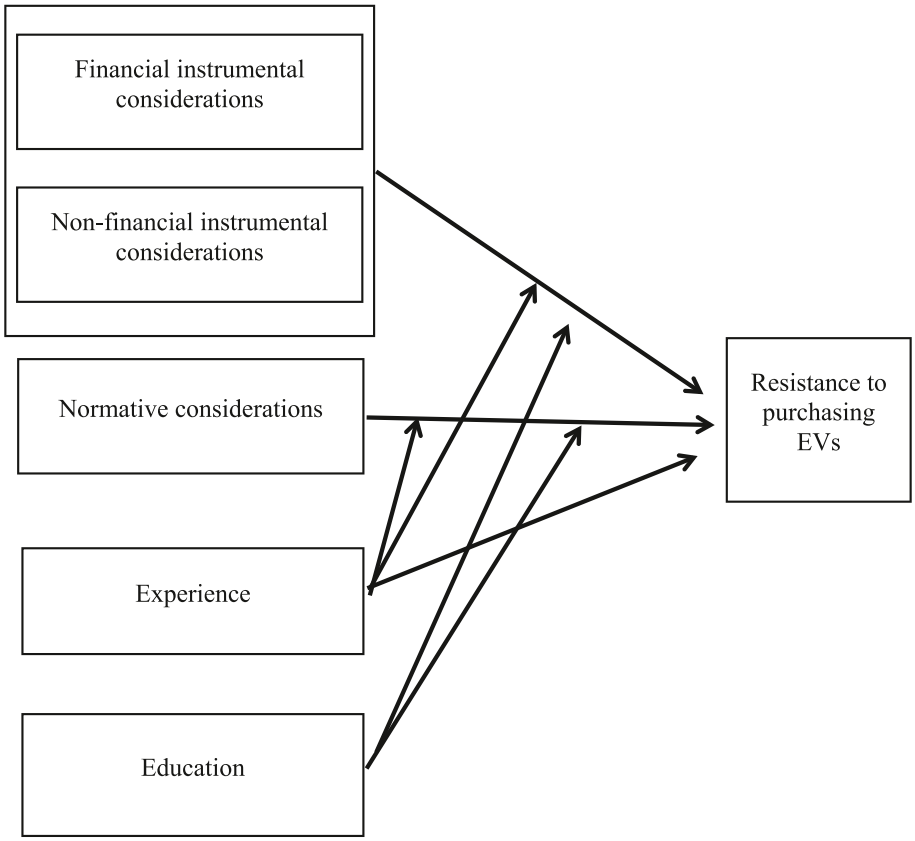

Fig. 1. The conceptual framework with proposed causes of the resistance to purchasing EVs.
Notes: The arrow from construct A to construct B indicates A influences B. The arrow from construct C to the arrow from A to B indicates that C moderates the impact of A on B.

figure, we refer to "willingness" as "resistance", which is simply the mirror image of willingness – we do so because this allows the regression coefficients reported later to be easily interpreted as identifying barriers to EV adoption.

The conceptual framework distinguishes financial instrumental considerations from non-financial instrumental considerations. First, because most people who might buy an EV already own a car, purchasing an EV would be what economists call a consumer durable replacement decision. According to rational choice theory, consumers will be open to considering an EV if it is expected to yield higher expected utility throughout ownership than a gas-powered vehicle would. The considerations that play roles in this analysis are financial instrumental considerations.

Second, since EVs are technologically innovative new consumer durables, purchasing an EV is akin to purchasing a computer. According to the TAM, consumers are likely to be influenced by perceived ease of use and usefulness considerations, which determine their technology acceptance. In addition, these two TAM perceptions are shaped by perceptions of system characteristics, which are instrumental factors that are non-financial considerations that determine the utility of using the product, such as safety, performance, and product features.

Third, because the use of EVs yields environmental benefits, normative considerations (a person's beliefs about what he or she should do) may enter consumers' purchasing decision-making processes. According to the norm-activation model (NAM), consumers are less likely to engage in pro-environmental thinking and action, such as considering the purchase of an EV, when they are unaware of other people's needs and of the effects of their own actions on other people. Lastly, some consumers have first-hand or second-hand experience with EVs, either by closely examining or driving the vehicles, or information provided to them by other people about their direct experiences with EVs. If favorable, these experiences can make people less resistant to EV purchasing.

2.1. *Financial instrumental considerations and hypotheses derived from rational choice theory*

2.1.1. *What is rational choice theory*

Rational choice theory is an individual decision-making framework used in economics and other disciplines that postulates that rational actors make decisions to maximize their own self-interest. According to philosopher and economist Adam Smith (1776), as explained in *The Wealth of Nations*, rational choice theory focuses on three concepts: rational actors, self-interest, and the invisible hand. Rational actors are individuals who make choices by evaluating an array of options based on the information available to them. Rational actors aim to maximize their self-interest through rational choice decision-making. The invisible hand refers to unseen forces that influence a free market economy. According to the theory, rational actors carefully assess and weigh the benefits and costs of each available option, given the information they possess, and choose the option they believe will maximize benefits to themselves.

The definition of rationality in this theory differs importantly from the word's meaning in everyday conversation. In the everyday sense, "rational" behavior refers to "sensible" or "predictable" behavior that is based on or in accordance with reason or logic. Rational choice theory adopts a more narrow and specific definition. Behavior is said to be rational if it is goal-oriented towards maximizing one's self-interest based on a person's assessment and weighing of benefits and costs. Thus, Friedman (1953, pp. 15–31) defined a rational choice as "balancing costs against benefits to arrive at action that maximizes personal advantage." Rational behaviors are specific to each rational

actor because the choices that one rational actor makes may seem irrational to another, because each actor aims to maximize his or her own unique personal advantages.

2.1.2. Assumptions in rational choice theory

According to Abell (2000), rational choice theory makes three main assumptions: individualism, optimality, and self-regard. The individualism assumption is the most fundamental and overarching. It states that individuals take actions, and individual actions collectively cause aggregate social outcomes. The optimality assumption asserts that rational actors choose their actions optimally given their individual preferences and constraints. Abell (2000) defined optimality as "given the set of opportunities faced, an individual chooses optimally if no other (social) action exists whose consequences he or she prefers to the chosen course of action." The self-regard assumption states that rational actors make decisions and choose actions driven only toward maximizing their own personal welfare.

Rational actors are assumed to be endowed with complete and perfect information about options in the choice sets and fixed preferences over the options. In addition, these preferences are thought to meet a few technical assumptions (e.g., Levin & Milgrom, 2004). For example, preferences are presumed to be complete, meaning that for any pair of alternatives (e.g., A and B), the actor prefers A to B, prefers B to A, or is indifferent between A and B. Also, preferences are thought to be transitive, in that if an actor prefers A to B and B to C, then he or she must prefer A to C; or if an actor is indifferent between A and B and indifferent between B and C, then he or she must be indifferent between A and C.

A utility function represents an actor's preference, and an actor's decision-making is formulated as a maximization of the utility function subject to constraints, such as a budget when choices have prices associated with them. For the maximization to work, certain assumptions must be made regarding the utility functions (see, e.g., Levin & Milgrom, 2004).

2.1.3. The financial instrumental considerations hypothesis

According to rational choice theory, an individual facing a choice between purchasing an EV or a gasoline-powered vehicle will assess the benefits and costs of each option. We propose that consumers make this assessment with a focus on what we call instrumental considerations. Financial instrumental considerations are beliefs about the life-cycle ownership of EVs, broadly over the spectrum of monetary costs. Life-cycle ownership refers to the entire duration of owning the object, from the initial investment (i.e., purchasing, operating, maintaining) to final disinvestment (disposing of it or reselling it).

Purchase price is the best-known and most universal factor governing consumer purchasing choices. Because the purchase prices of EVs are well-publicized, consumers likely have a good understanding of how to factor price into purchasing decisions. Perhaps less well-known and less publicized are the other costs associated with owning EVs, including operating expenditures and fuel costs, the costs of maintenance and repairs, and depreciation of EVs relative to that of gasoline-powered vehicles.

Past studies of EV purchasing have primarily examined the impacts of purchase price and fuel costs on consumer decisions (Adepetu & Keshav, 2015; Barth, Jugert, & Fritsche, 2016; Buhler et al., 2014; Graham-Rowe et al., 2012; Hoen & Koetse, 2014; Jensen, Cherchi, & Mabit, 2013). Only one study investigated the influence of maintenance costs on EV purchasing (Graham-Rowe et al., 2012), and none have considered depreciation. By examining these life-cycle cost factors simultaneously in predicting willingness to consider an EV purchase, we can determine which instrumental factors influence resistance.

Given this background, the conceptual framework suggests the following:

H1. Resistance to purchasing an EV will be higher when the financial instrumental considerations of EVs have higher monetary cost than those of gasoline-powered vehicles.

2.2. Non-financial instrumental considerations and hypotheses based on the TAM

2.2.1. The TAM and its extensions

Based on the TRA, the TAM seeks to explain an individual's acceptance of information technology and information systems (Davis, 1989; Davis, Bagozzim, & Warshaw, 1989). The TAM narrows beliefs about the object (an information system, in this case) to only two: perceived usefulness and perceived ease of use of the object. Perceived usefulness is defined as the prospective user's subjective probability that the behavior's consequences will benefit his or her personal experience. Perceived ease of use is defined as the prospective user's subjective judgment of the likelihood that performing the behavior will be costly. These beliefs determine a prospective user's attitude toward use, which is an evaluation of the desirability of using a specific information system. Attitude toward use determines system use in the original TAM model (Davis, 1986). Perceived usefulness and ease of use are hypothesized to be influenced by system design characteristics (Davis, 1986).

In addition to three modifications of the TAM (Davis, 1989; Davis, Bagozzim, & Warshaw, 1992; Venkatesh & Davis, 1996), several extensions have been proposed (Taylor & Todd, 1995; Venkatesh & Davis, 2000). Considering the consistent finding that perceived usefulness is a major determinant of intention to use (Davis, 1989; Davis, Bagozzim & Warshaw, 1992), Venkatesh and Davis (2000) identified additional factors that influence perceived usefulness, yielding the TAM2. This model proposes that subjective norms, image, job relevance, output quality, and result demonstrability determine perceived usefulness. According to the TAM2, image is the actor's desire to maintain a favorable self-image in the eyes of other people. Job relevance and output quality are defined as the extent to which the object technology applies to the user's job performance and performs the tasks involved in the user's job, respectively. Finally, result demonstrability is the degree to which tangible results are achieved through use of the technology. The TAM2 proposes that experience and voluntariness be included as moderating variables of the relationship between subjective norms and perceived usefulness, as well as the newly proposed relationship between subjective norms and behavioral intention (for additional extensions of the TAM2, see Van Raaij & Schepers, 2008; Venkatesh, 2000; Venkatesh & Davis, 2000; Venkatesh, Morris, Davis, & Davis, 2003; Venkatesh, Thong, & Xu, 2012).

2.2.2. The non-financial instrumental considerations hypothesis

Because of the central roles that software programs play in EV operation, EVs have earned the name, "computers on wheels." Thus, purchasing EVs can be thought of as analogous to adopting information systems such as computers and software. In this context, the TAM points to various non-financial instrumental considerations as determinants of the utility of consuming the product upon ownership, including product safety, product performance, product features, and required infrastructure readiness. All of these factors are implicated in the TAM2 (Venkatesh & Davis, 2000), as these are system characteristics that determine perceived ease-of-use and perceived usefulness. According to this model, the greater the perceived ease-of-use of the technology, the more likely consumers will be to accept it. Analogously, when EVs are perceived to be safe and to perform well relative to gasoline-powered vehicles, and when infrastructure is available to support EV life cycle needs, consumers will be less resistant to EVs.

In this context, safety concern seems appropriately operationalized by the perceived likelihood that EV batteries will catch on fire, which has occurred (Foldy, 2020b). Only two past studies have examined this safety factor (Egbue & Long, 2012; Graham-Rowe et al., 2012), so the current investigation of this factor is relatively novel. Perhaps safety concerns associated with EVs enhance consumer resistance to entering the EV market.

Performance considerations regarding EVs are operationalized in terms of perceived acceleration relative to that of gasoline-powered vehicles, a factor that only one past study has examined (Skippon & Garwood, 2011). Infrastructure availability is operationalized in terms of the difficulty of charging batteries, including refueling time or availability of charge stations (which can lead to range anxiety) and the availability of mechanics capable of repairing EVs. Driving range is the most examined factor in the EV adoption literature (see Li, Long, Chen, & Geng, 2017): half of a set of 40 past studies investigated the impact of driving range. The current investigation also explores whether perceived charging inconvenience contributes to consumer resistance to adopting EVs. No past studies have explored the impact of availability of car mechanics to repair EVs. We assess whether perceived availability of suitable mechanics may be a deterrent to the public considering purchasing EVs.

We therefore set forth to test the following hypothesis:

H2. Resistance to purchasing an EV will be lower when non-financial instrumental considerations of EVs are perceived to have higher utility than those of gasoline-powered vehicles.

2.3. Normative considerations and hypotheses derived from the NAM

2.3.1. Extensions of rational choice theory and the NAM

Several extensions have been made to rational choice theory to address the theory's limitations by relaxing some of its strong assumptions and explain human behaviors more realistically. One such extension involves the incorporation of personal moral norms. For example, the notion of "impure altruism" is that individuals sometimes receive a "warm glow" benefit from contributing to the public good, i.e., by taking an action that benefits other people. Such an action may be seen as "prestigious" and "distinctive" by observers, thus enhancing an individual's perceived social status. Likewise, an actor might receive "social approval" by partaking in popular behaviors, simply by virtue of conforming to behavioral norms. Individuals with a preference for a warm glow are thought to make choices that benefit the public good, but in a self-serving way. In this sort of adaptation of rational choice theory to incorporate moral norms, moral motivation and self-interest are not mutually exclusive and instead are both drivers of utility maximation.

An important supplement to rational choice theory is the norm-activation model (NAM), which was developed to explain individuals' altruistic or pro-social behavior (Schwartz, 1977; Schwartz & Howard, 1981). The NAM explains helping behavior based on internalized or "personal" norms, reflecting people's personal value systems. The NAM is a sequential model, proposing an ordered sequence of norm activation and feelings of moral obligation, and this sequence determines engagement in helping behavior. Exposure to information about other people's needs shape perceptions that a problem should be addressed (Awareness of Need). That perception leads to the activation of personal norms. Activation of a personal norm is said to lead to feeling morally obligated to help people in need. Following activation of a moral obligation, an individual might evaluate the costs of engaging in helping behavior as being substantial, and this may reduce the likelihood that the individual will engage in that behavior. The NAM proposes two moderators of the impact of activated norms on helping behavior: impact is said to be stronger when the individual is aware of the consequences of his or her own behavior for others (Awareness of Consequences) and when the individual does not deny his or her own responsibility for the effects of their behavior on others (Responsibility Denial).

2.3.2. The normative considerations hypothesis

Moral theories, including the NAM and the Value-Belief-Norm model, are not in conflict with rational choice theory. Rather, these theories are complementary, because a rational actor derives positive utility from conformance with personal norms. As in any choice context, an individual assesses and compares the utility of conforming to an activated personal norm to the cost of violating the activated personal norm. If net utility is perceived to be positive, the individual will engage in pro-environmental behavior that is consistent with their personal norm. Likewise, if net utility is negative, the individual will forgo the pro-environmental behavior.

The present study explores two normative considerations implicated by the NAM: Awareness of Need and Awareness of Consequences. Perception of global warming as a serious problem is an Awareness of Need belief, because driving an EV may be viewed as helping solve the problem of global warming if that problem exists, and if EVs are perceived to reduce climate-altering emissions. Believing that driving EVs is helpful to the environment is an Awareness of Consequences belief.

Both of these normative considerations align with the Comprehensive Action Determination Model (Klockner, 2013; Klockner & Blobaum, 2010), and both have been examined in past studies. For example, previous work has shown that people with heightened environmental awareness or concern are more likely to adopt EVs (e.g., Beck, Rose, & Greaves, 2017; Graham-Rowe et al., 2012; Hackbarth & Madlener, 2013, 2016; Hidrue, Parsons, Kempton, & Gardner, 2011; Lai, Liu, Sun, Zhang, & Xu, 2015; Sang & Bekhet, 2015; Sierzchula, Bakker, Maat, & van Wee, 2014; Skippon & Garwood, 2011). Similarly, perceiving environmental benefits of driving EVs has been shown to promote their adoption (e.g., Axsen & Kurani, 2013; Barth et al., 2016; Burgess, King, Harris, & Lewis, 2013; Egbue & Long, 2012; Graham-Rowe et al., 2012; Noppers, Keizer, Bolderdijk, & Steg, 2014; Skippon & Garwood, 2011).

Therefore, we hypothesize that:

H3. Resistance to purchasing an EV will be lower when normative considerations regarding EVs are more favorable than those regarding gasoline-powered vehicles.

2.4. Experience and hypotheses derived from Mere Exposure Theory

According to Mere Exposure Theory, people develop a more favorable attitude toward an object as the result of mere exposure to it (Zajonc, 1968). So Mere Exposure Theory predicts that experience with a technology might enhance the positivity of attitudes toward the technology and encourage purchasing or using it. Inspired by that literature and by past studies on EV adoption that found experience enhanced attitude positivity and reduced purchase resistance (Thogersen & Ebsen, 2019), we explored whether people with EV experience are less likely to resist purchasing EVs.

H4. Resistance to purchasing an EV will be lower when a person has had experience with EVs.

2.5. Moderating roles of education and experience

This conceptual framework also includes proposals regarding moderating roles of education and experience. Specifically, we propose that education may moderate the impact of instrumental and normative considerations. When purchasing expensive and technologically complex products such as EVs, consumers are confronted with many competitive alternatives. Considering each alternative requires digesting extensive descriptions of the specifications and functionalities of the product. Gathering, processing, comparing, and integrating the large array of information available about the attributes of competing alternatives entails substantial cognitive work and psychological involvement (e.g., Abramson & Desai, 1993), which may diminish consumer incentives to venture into a new market. Consequently, consumers without the experience or time to thoughtfully 'comparison shop' may hesitate before buying EVs, to avoid expending the effort required to gather, sift, and process their technical specifications. Alternatively, individuals may resist considering purchasing EVs based on a small set of considerations to minimize their effort, relying on heuristic shortcuts

(e.g., Kahneman, 2003), such as personal norms and values.

This kind of behavior is referred to as "satisficing" rather than "maximizing" and is prevalent in consumer decision-making in economics as an alternative to rational choice theory (see Simon, 1955; in social cognition framework, e.g., Schwarz, 1995). For example, survey respondents often exhibit "satisficing," and the likelihood to satisfice increases with lower respondent ability, lower respondent motivation, and greater task difficulty (e.g., Krosnick, 1991). Satisficing is also more prevalent generally among less-educated respondents (e.g., Krosnick, Narayan, & Smith, 1996). In the case of EV resistance, holding consumer motivation constant, the task required of a "maximizer" to gather, process, and integrate information is challenging. Therefore, satisficing may be more likely among less educated consumers. The conceptual framework assumes that instrumental considerations, including cost and utility considerations, can influence consumer choice via an effortful cost-benefit analysis that constitutes maximizing, which is most likely to be implemented by people with strong cognitive skills and strong motivation to be thoughtful.

Therefore, we propose:

H5a. Instrumental considerations may have less impact on EV purchasing resistance among less educated consumers.

In contrast, normative considerations can serve as easy-to-use heuristics that people who engage in satisficing can employ, rather than expending the costly cognitive effort of maximizing.

Therefore, we propose:

H5b. Normative considerations may have more impact on EV purchasing resistance among less educated consumers.

We also explore whether education moderates the impact of experience on resistance. However, we have no theory-based expectations about the direction of this moderation.

Via a similar line of reasoning, we hypothesize that prior experience may moderate the impact of instrumental and normative considerations. Specifically, the impact of instrumental factors, including cost and utility considerations, may vary depending on a person's experience with EVs. Prior experience may enhance the accuracy of perceptions of EVs and the confidence with which they are held (Fazio & Zanna, 1981; Regan & Fazio, 1977). Instrumental considerations may therefore predict resistance to EVs more strongly among people with EV experience than among people without. Perceptions of normative considerations, such as concern about climate change and perception of how much an emission-free EV will help the environment, may be invariant, regardless of whether one has experience with EVs or not. And people who do not have past experience with EVs may rely less on instrumental factors and more on normative considerations.

Therefore, we derive the following hypotheses:

H6a. Instrumental considerations may be less influential on EV purchasing resistance among consumers without EV experience than among people with EV experience.

H6b. Normative considerations may be more influential on EV purchasing resistance among consumers without EV experience than among people with EV experience.

3. Method

3.1. Sample

The above hypotheses were tested using data from the 2020 National Survey of Public Opinion on Global Warming, which was conducted by the Political Psychology Research Group at Stanford University, Resources for the Future, and ReconMR. Random Digit Dialing telephone interviews were conducted with a representative sample of 502 adults living in the United States.[3] 183 respondents were interviewed on a landline telephone, and 319 were interviewed on a cell phone. Interviewing was conducted between May 28 and August 10, 2020, in English. The AAPOR Response Rate 3 for the survey was 22% for the landline frame, 5% for the cell phone frame, and 9% for both (see Appendix A in the Online Supplement for the survey methodology). The data were weighted to match the U.S. adult population using benchmarks from the March 2020 Current Population Survey for sex, age, race and ethnicity, education, and census region (see Appendix A in the Online Supplement for the details on how weights were computed; see Table A1 in the Online Supplement for the distributions of these demographics in the sample and the U.S. adult population).

3.2. Measures

3.2.1. Resistance to purchasing EVs

The dependent measure is resistance to purchasing an EV. Respondents were first asked: "Do you think you will buy a car in the future, or do you think you will not do that?" 313 respondents who said they will purchase a car were then asked, "When you buy a car next, do you think you will consider buying a car that runs only on electricity, or do you think you won't consider buying that type of car?" Respondents were coded 1 if they said they would not consider buying an all-electric car and 0 if they said they would, for a total N of 303, with 10 respondents that said they did not know. These 10 respondents were excluded from the regressions.

3.2.2. Predictors of resistance to purchasing EVs

The predictors are measures of instrumental considerations, normative considerations, and experience, and their question wordings and summary statistics are delineated in Table 1.

All respondents were asked seven questions measuring instrumental considerations, including three financial and four non-financial considerations. Cronbach's alpha for the seven instrumental measures was 0.54, suggesting that they are separate variables and should be included in the analysis as individual predictors. Furthermore, when that was done, the average variance inflation factor (VIF) of all predictors was 4.7, and the average VIF of these seven instrumental considerations was 6.6, indicating little evidence of collinearity.

The three measures of financial instrumental considerations are maintenance costs, operating costs, and depreciation. Cronbach's alpha for the three financial instrumental considerations was 0.47, suggesting that they should be included in the analysis as separate variables. However, we also conducted analyses using an index as the average over these measures to yield an "induced variable" (see Alwin, 1988).

The four non-financial instrumental considerations are safety, performance (acceleration), existence of infrastructure regarding charging inconvenience, and unavailability of mechanics. The Cronbach's alpha for the four non-financial instrumental considerations was 0.29, suggesting that they should be included in the analysis as separate variables. However, we also did analyses using an index as the average over these variables to yield an induced variable.

All respondents were asked two questions measuring normative considerations that might constitute sources of resistance to purchasing EVs: awareness of needs and awareness of consequences. Cronbach's alpha for the two normative measures was 0.73, suggesting that an index may be computed as the average over the above two measures.

All respondents were asked one question about prior experience.

[3] Questions about electric vehicles were added to the questionnaire after 43 interviews were conducted; the total sample size for the electric vehicles questions is 459.

Table 1
Measures in the three categories of considerations.

Considerations	Measure	Question wording and coding	Summary statistics
Financial instrumental considerations			
Maintenance costs	Maintaining EVs is more costly than maintaining gasoline-powered cars	"As compared to cars that run on gasoline, do you think that people who own cars that run only on electricity spend more money to repair them and keep them running (1), spend less money on that (0), or spend about the same amount of money (.5)?"	N = 286, Mean = .59, S.D. = .33, Min = 0 Max = 1
Operating costs	Driving EVs is more costly than driving gasoline-powered cars	"People who drive cars that run only on electricity have to pay for the electricity to charge the cars' batteries. As compared to the cost of gasoline to drive one mile, do you think the cost of electricity to drive one mile is more (1), less (0), or the same (.5)?"	N = 287, Mean = .36, S.D. = .40, Min = 0 Max = 1
Depreciation	EVs lose value more quickly than do gasoline-powered cars	"As you may know, the more miles a car has been driven, the less money the owner can sell it for. As compared to cars that run on gasoline, do you think the value of cars that run only on electricity goes down faster over the years (1), goes down more slowly (0), or goes down about equally fast (.5)?"	N = 292 Mean = .42 S.D. = .33 Min = 0 Max = 1
Financial instrumental consideration index			N = 272 Mean = .45 S.D. = .25 Min = 0 Max = 1 Cronbach's α = .47
Non-financial instrumental considerations			
Safety	EV batteries are likely to catch on fire	"How likely do you think it is that the batteries in cars that run only on electricity will catch on fire? Extremely likely (1), very likely (.75), moderately likely (.5), slightly likely (.25), or not likely at all (0)?"	N = 294 Mean = .27 S.D. = .27 Min = 0 Max = 1
Performance	EVs have poorer acceleration than gasoline-powered cars	"As compared to cars that run on gasoline, do you think that the engines of cars that run only on electricity can speed up more quickly (0), speed up more slowly (1), or speed up about equally fast (.5)?"	N = 290 Mean = .45 S.D. = .38 Min = 0 Max = 1
Infrastructure on charging	Charging EV batteries is difficult	"How difficult do you think it is for people who drive cars that run only on electricity to find places to charge them up when they need to be charged? Extremely difficult (1), very difficult (.75), moderately difficult (.5), slightly difficult (.25), or not difficult at all (0)?"	N = 301 Mean = .59 S.D. = .28 Min = 0 Max = 1
Infrastructure on repairment	Mechanics to fix EVs are less available than mechanics to fix gasoline-powered cars	"How many car mechanics would you guess can fix cars that run only on electricity? All of them (0), most of them (.25), about half of them (.5), a few of them (.75), or none of them (1)?"	N = 301 Mean = .64 S.D. = .20 Min = 0 Max = 1
Non-financial instrumental consideration index			N = 283 Mean = .48 S.D. = .16 Min = 0 Max = 1 Cronbach's α = .29
Normative considerations			
Awareness of needs	GW will not be a serious national problem	"If nothing is done to reduce global warming in the future, how serious of a problem do you think it will be for the United States? Very serious (0), somewhat serious (.33), not so serious (.67), or not serious at all (1)?"	N =303 Mean = .25S.D. = .36 Min = 0 Max = 1
Awareness of consequences	Driving EV will not help the environment	"As compared to driving a car that runs on gasoline, how much do you think that driving an all-electric car helps the environment? A great deal (0), a lot (.75), a moderate amount (.5), a little (.25), or not at all (0)?"	N =302 Mean = .38S.D. = .35 Min = 0 Max = 1
Normative consideration index			N = 302 Mean = .34 S.D. = .32 Min = 0 Max = 1 Cronbach's α = .73
Experience	Had not experienced EV	"As far as you know, have you or anyone you know personally ever driven a car or truck that runs only on electricity and not	N = 301 Mean = .61 S.D. = .49 Min = 0 Max = 1

(*continued on next page*)

Table 1 (*continued*)

Considerations	Measure	Question wording and coding	Summary statistics
		on gasoline (0), or has that not happened (1)?"	

3.2.3. Party identification, liberal/conservative ideology, and demographics

Other predictors include party identification, liberal/conservative ideology, and demographics, including sex, age, race, Hispanic ethnicity, education, income, and region of residence (see Appendix B in the Online Supplement for question wordings and codings). A series of dummy variables identifying respondents who did not answer each predictor in the regressions, including substantive measures and demographics (coded 1 for people who did not answer and 0 for people who did) were included as predictors in the regressions. All respondents who did not answer a predictor measure were assigned the same arbitrary value, such as 0, on that variable.ables identifying respondents who did not answer one or more constituents in each index (coded 1 for people who did not answer all the constituents in the index and 0 for people who did) were included as predictors in the regressions. The indices were created as the average of all the constituents, and the value of the constituent was 0 for respondents who did not answer it. Therefore, we could employ the indicator approach to managing missing data (Cohen & Cohen, 1975). This avoids losing cases while also preventing distortion of parameter estimates.

3.3. Analytic methodology

To gauge the impact of potential inhibitors of resistance to purchasing an EV, we estimated the parameters of an ordinary least squares regression predicting resistance to purchasing EVs with financial instrumental considerations, non-financial instrumental considerations, normative considerations, experience, party identification, liberal/conservative ideology, and demographics. The financial instrumental considerations are maintenance costs, operating costs, and depreciation, while non-financial instrumental considerations include safety, performance, infrastructure for charging, and repair. Normative considerations consist of awareness of needs and awareness of consequences.

We tested these hypotheses using ordinary least squares (OLS) regressions in two ways. First, one regression predicted resistance using all of the ten measures treated as separate constructs, called Model 1. Second, we predicted resistance using the averages of indicators in each of the three categories in the conceptual framework (e.g., financial instrumental considerations), called Model 2. In much research, averaging or otherwise combining a series of measures to yield an index score is done based on the assumption that a single underlying latent construct caused the various measures, so Cronbach's alpha reveals the degree to which the measures reflect that latent construct. We did not build each of these indices based on that logic. Rather, the indices are best viewed as "induced variables" (e.g., Heise, 1972), meaning that the construct is caused by the indicators, rather than a latent construct causing the indicators.[4] Analyses treating each measure as an individual predictor fully reveal for readers which considerations are related to resistance. The additional analyses treating the three categories as indices are useful to explore the impact of the three categories of predictors. But it is important to note that the measures used to build each of these indices are not comprehensive (meaning that some other determinants in each of the three categories have probably not been measured), so it would not be appropriate to conclude that the associations of the indices with resistance would be the same using other measures to build the indices.

To assess the role of each proposed moderator, we first estimated the parameters of an OLS regression predicting resistance to purchasing EVs allowing main effects of the three indices and proposed moderators, as well as interactions between each of the indices and each of the proposed moderators, controlling for party identification, liberal/conservative ideology, and demographics. As a robustness check, the parameters of an OLS regression were also estimated to test for moderation of the impact of the ten predictors kept separate from each other, as well as interactions. This second approach yielded results broadly consistent with those of the regression using indices (see Table A2 in the Online Supplement for regression coefficients).

4. Results

4.1. Predicting resistance to purchasing an EV with instrumental considerations

In Model 1, perceiving greater maintenance costs of EVs predicted resistance ($b = 0.212$, $p < .05$; row 1 column 1 in Table 2). Perceiving that EVs are more expensive to operate and depreciate more quickly than gasoline-powered cars did not exacerbate resistance ($b = 0.105$, n. s.; $b = 0.099$, n. s.; rows 2 and 3 column 1 in Table 2).[5] In Model 2, perceiving greater financial instrumental considerations of EVs strongly and positively predicted resistance ($b = 0.385$, $p < .001$; row 4 column 2 in Table 2). These findings lend support to hypothesis H1.

In Model 1, perceiving that EV batteries pose a safety hazard substantially increased resistance ($b = 0.269$, $p < .05$; row 5 column 1 in Table 2). Perceiving that EVs have poorer acceleration than gasoline-powered cars enhanced resistance to purchasing EVs marginally

[4] As Heise (1972) explained, a prototypical induced variable is socioeconomic status, a construct that has been studied in thousands of publications. Socioeconomic status (SES) is a reflection of a person's educational attainment, occupational prestige, and income (APA, 2006). But SES is not thought to be a latent variable that causes a person's education, occupation, or income. Rather, SES is an abstract notion that is the "sum" of a person's education, occupation, and income. A person with extremely high amounts of schooling, a high prestige job, and a huge income is, by definition, high in SES. Although a measure such as Cronbach's alpha can be computed to indicate the degree of overlap of education, occupational prestige, an income, alpha could be very small in a particular dataset, and yet combining measures of schooling, occupation, and income to yield an index representing the induced variable called SES is still legitimate. The indices we created in this investigation are also induced variables in this sense – we combined various measures of, for example, financial instrumental considerations to yield an index, regardless of correlations among them.

[5] The sheaf coefficients, which capture the relative strength of the influence of clusters of variables (i.e., the categories in the conceptual framework: normative, financial instrumental and non-financial instrumental considerations), were computed from the results of the first model according to the "induced variable" approach (Heise, 1972) (see Appendix C and Table A3 in the Online Supplement).

Table 2
Unstandardized OLS regression coefficients predicting resistance to purchasing all-electric vehicles.

Predictor	Model 1	Model 2
Financial instrumental considerations		
Maintaining EVs is more costly than maintaining gasoline-powered cars	0.212*	
	(0.029–0.395)	
Driving EVs is more costly than driving gasoline-powered cars	0.105	
	(-0.029–0.239)	
EVs lose value more quickly than do gasoline-powered cars	0.099	
	(-0.080–0.278)	
Financial instrumental consideration index		0.385***
		(0.180–0.591)
Non-financial instrumental considerations		
EV batteries are likely to catch on fire	0.269*	
	(0.039–0.499)	
EVs have poorer acceleration than gasoline-powered cars	0.151+	
	(-0.005–0.307)	
Charging EV batteries is difficult	0.028	
	(-0.168–0.225)	
Mechanics to fix EVs are less available than mechanics to fix gasoline-powered cars	0.134	
	(-0.160–0.428)	
Non-financial instrumental consideration index		0.614***
		(0.278–0.951)
Normative considerations		
GW will not be a serious national problem	0.306**	
	(0.122–0.490)	
Driving EV will not help the environment	0.036	
	(-0.135–0.207)	
Normative consideration index		0.364***
		(0.174–0.554)
Experience		
Had not experienced EV	−0.050	−0.037
	(-0.163–0.063)	(-0.144–0.069)
Parry ID, ideology, and demographics		
Democrat	0.112	0.113
	(-0.026–0.249)	(-0.027–0.253)
Republican	0.086	0.088
	(-0.073–0.246)	(-0.073–0.249)
Liberal	−0.165*	−0.158*
	(-0.301– −0.028)	(-0.289– −0.027)
Conservative	0.071	0.103
	(-0.075–0.218)	(-0.034–0.241)
Male	0.032	0.041
	(-0.082–0.145)	(-0.074–0.156)
Hispanic	−0.047	−0.086
	(-0.205–0.111)	(-0.247–0.075)
Black	0.112	0.128
	(-0.041–0.264)	(-0.030–0.286)
Other race(s)	−0.010	0.000
	(-0.175–0.155)	(-0.167–0.168)
Age 25 to 34	−0.012	−0.023
	(-0.182–0.157)	(-0.203–0.158)
Age 35 to 44	0.055	0.056
	(-0.131–0.240)	(-0.134–0.246)
Age 45 to 54	0.086	0.083
	(-0.104–0.277)	(-0.114–0.281)
Age 55 to 64	0.219*	0.224*
	(0.031–0.407)	(0.031–0.416)
Age 65 or older	0.096	0.074
	(-0.086–0.279)	(-0.112–0.260)
High school graduate	0.297*	0.256+
	(0.021–0.574)	(-0.025–0.537)
Some college	0.171	0.129
	(-0.106–0.448)	(-0.144–0.403)
College graduate	0.228	0.183
	(-0.078–0.533)	(-0.109–0.476)
Post college schooling	0.190	0.134
	(-0.115–0.495)	(-0.161–0.429)
Income $20K-$34,999	0.039	0.104
	(-0.198–0.276)	(-0.130–0.338)
Income $35K-$49,999	−0.006	0.016
	(-0.255–0.244)	(-0.216–0.247)
Income $50K-$74,999	0.173	0.187+
	(-0.068–0.414)	(-0.031–0.404)
Income $75K-$99,999	0.091	0.093
	(-0.109–0.291)	(-0.102–0.289)
Income $100K+	0.000	0.020
	(-0.215–0.216)	(-0.186–0.226)
Married	−0.086	−0.087
	(-0.209–0.037)	(-0.210–0.035)
Northeast	−0.118+	−0.123+
	(-0.252–0.016)	(-0.263–0.017)
Midwest	0.081	0.087
	(-0.069–0.231)	(-0.071–0.245)
West	−0.057	−0.038
	(-0.183–0.070)	(-0.163–0.088)
Constant	−0.404*	−0.453*
	(-0.781–−0.026)	(-0.810– −0.096)
R^2	0.491	0.480
N	303	303

Notes. Cell entries in the last two columns are unstandardized coefficients (95% confidence intervals in parentheses) from OLS regressions, adjusted for sampling weights. Additional control variables were indicators of whether each measure had missing data, and coefficients for these variables are omitted from the table for the brevity of presentation. Each column is a separate regression.
***p < .001 **p < .01 * p < .05 +p < .10

significantly (b = 0.151, p < .10; row 6 column 1 in Table 2). Perceived difficulty charging batteries and unavailability of mechanics to repair EVs did not enhance resistance (b = 0.028, n. s.; b = 0.134, n. s.; rows 7 and 8 column 1 in Table 2). In Model 2, perceiving greater non-financial instrumental considerations of EVs strongly and positively predicted resistance (b = 0.614, p < .001; row 9 column 2 in Table 2). These findings support hypothesis H2.

4.2. Predicting resistance to purchasing an EV with normative considerations

In Model 1, believing that global warming will be a less serious problem for the nation strongly and positively predicted resistance (b = 0.306, p < .01; row 10 column 1 in Table 2). But controlling for perceived seriousness of global warming, perceiving that driving EVs helps the environment did not reduce resistance (b = 0.036, n. s., row 11 in Table 2). In Model 2, when the two normative considerations were combined into an index, more unfavorable normative considerations of EVs (i.e., lower awareness of needs and awareness of consequences) strongly and positively predicted resistance (b = 0.364, p < .001; row 12 column 2 in Table 2). These findings lend support to hypothesis H3.

4.3. Predicting resistance to purchasing an EV with experience

Prior experience with driving EVs did not reduce resistance (b = −0.050, n. s.; row 13 column 1; b = −0.037, n. s.; row 13 column 2 in Table 2 in Model 1 and Model 2, respectively). This finding does not support hypothesis H4.

4.4. Moderators of the predictors of resistance

Education moderated the impact of some predictors of resistance. Education did not moderate the impact of financial or non-financial instrumental considerations (interactions of financial and non-financial instrumental consideration indices with education: b = 0.124, n. s.; b = −0.093, n. s.; rows 3 and 5 in Table 3, respectively). This finding is inconsistent with the expectation that more educated people

Table 3
Unstandardized OLS regression coefficients predicting resistance to purchasing all-electric vehicles with moderation by education and experience.

Predictor	Unstandardized OLS regression coefficients
Financial instrumental considerations	
Financial instrumental consideration index	0.656***
	(0.272–1.040)
Financial instrumental consideration index × College degree	0.124
	(-0.292–0.541)
Financial instrumental consideration index × No experience	−0.384+
	(-0.788–0.020)
Non-financial instrumental considerations	
Non-financial instrumental consideration index	0.843**
	(0.271–1.415)
Non-financial instrumental consideration index × College degree	−0.093
	(-0.651–0.465)
Non-financial instrumental consideration index × No experience	−0.358
	(-0.984–0.269)
Normative considerations	
Normative consideration index	0.338*
	(0.054–0.622)
Normative consideration index × College degree	−0.393*
	(-0.695-−0.091)
Normative consideration index × No experience	0.323*
	(0.031–0.615)
Experience	
Had not experienced EV	0.023
	(-0.321–0.368)
Had not experienced EV × College degree	0.313**
	(0.106–0.520)
Parry ID, ideology, and demographics	
Democrat	0.114
	(-0.024–0.252)
Republican	0.088
	(-0.054–0.231)
Liberal	−0.190**
	(-0.324-−0.056)
Conservative	0.068
	(-0.058–0.194)
Male	0.092
	(-0.018–0.202)
Hispanic	−0.089
	(-0.236–0.057)
Black	0.123
	(-0.033–0.280)
Other race(s)	−0.015
	(-0.165–0.136)
Age 25 to 34	−0.029
	(-0.206–0.148)
Age 35 to 44	0.034
	(-0.153–0.221)
Age 45 to 54	0.072
	(-0.112–0.255)
Age 55 to 64	0.163+
	(-0.027–0.353)
Age 65 or older	0.037
	(-0.155–0.229)
College degree	−0.062
	(-0.367–0.243)
Income $20K-$34,999	0.142
	(-0.079–0.363)
Income $35K-$49,999	−0.011
	(-0.221–0.198)
Income $50K-$74,999	0.209*
	(0.001–0.417)
Income $75K-$99,999	0.100
	(-0.080–0.280)
Income $100K+	0.052
	(-0.142–0.246)
Married	−0.101
	(-0.223–0.021)
Northeast	−0.139*
	(-0.269-−0.009)
Midwest	0.067
	(-0.086–0.221)
West	−0.060
	(-0.178–0.057)
Constant	−0.368+
	(-0.766–0.031)
R^2	0.503
N	297

Notes. Cell entries in the last column are unstandardized coefficients (95% confidence intervals in parentheses) from OLS regressions among respondents who reported valid data on education and experience with EVs, adjusted for sampling weights. Additional control variables were indicators of whether each measure has missing data. Coefficients for these variables are omitted from the table for the brevity of presentation.
***p < .001 **p < .01 * p < .05 +p < .10

will rely more heavily on instrumental considerations and does not support hypothesis H5a. Education moderated the impact of normative considerations on resistance. Consistent with expectations, more educated people were less driven by normative considerations (interaction of normative consideration index with education: b = −0.393, p < .05; row 8 in Table 3), lending support to hypothesis H5b. Furthermore, more educated people were more driven by experience (interaction of experience with education: b = 0.313, p < .01; row 11 in Table 3), a discovery for which we see no obvious theory-based explanation.

Experience with EVs also moderated the impact of some predictors of resistance. Consistent with expectations, people without experience were marginally significantly less influenced by financial instrumental considerations than those with experience (interaction of financial instrumental consideration index with experience: b = −0.384, p < .10; row 3 in Table 3). However, inconsistent with expectations, having no experience with EVs did not moderate the impact of non-financial instrumental considerations (interaction of non-financial instrumental consideration index with experience: b = −0.358, n. s.; row 6 in Table 3). These findings provide partial support for hypothesis H6a. People with no experience were more driven by normative considerations than were people with experience (interaction of normative consideration index with experience: b = .323, p < .05; row 9 in Table 3), supporting hypothesis H6b.

5. Discussion

According to these data, only 57% of future American car buyers were willing to consider purchasing an EV, illustrating that resistance was rampant. By testing hypotheses in a conceptual framework derived from prior work in economics, psychology, and the environmental sciences, this research explored the determinants of that resistance and yielded four principal findings.

First, instrumental considerations, both financial and non-financial, were strong predictors of resistance. This is consistent with expectations derived from the rational choice and reasoned action frameworks. If perceptions of financial and non-financial considerations become more favorable with the advancement of EV manufacturing and infrastructure in the future, resistance to purchasing an EV seems likely to decline.

Second, normative considerations were strong predictors of resistance, a finding consistent with the integration of rational choice theory

with moral theories. If these perceptions of environmental threat become more favorable in the future, resistance to purchasing an EV seems likely to decrease as well.

Third, experience with EVs did not predict resistance directly. That is, mere exposure to EVs, either first-hand or second-hand, did not reduce resistance. According to this finding, as more people experience or hear about experiences of owning EVs, this alone will not weaken resistance.

Fourth, education moderated the impact of normative considerations on resistance to purchasing EVs. More educated people were less driven by normative considerations. Additionally, direct or vicarious experience with EVs moderated the influence of financial instrumental considerations and normative considerations. People without experience were more driven by normative considerations and less driven by financial instrumental considerations than people with experience.

These findings highlight the relative importance of the considerations tested and the value of the conceptual framework from which the tested hypotheses were derived. Rational choice theory appears to be the most useful for understanding consumer resistance, because financial instrumental considerations were the most potent predictors. The next most influential were predictors derived from the TAM and the NAM: non-financial instrumental considerations and normative considerations were strong drivers of resistance.

5.1. Resonance with the past research

Some of the findings of the present study resonate with comparable findings in past studies of EV adoption. For example, paralleling our findings predicting EV resistance, previous studies showed that EV adoption was negatively associated with higher perceived maintenance costs (Graham-Rowe et al., 2012), perceptions of poorer performance of EVs (Skippon & Garwood, 2011), and less concern about the environment (e.g., Beck et al., 2017; Graham-Rowe et al., 2012; Hackbarth & Madlener, 2013, 2016; Hidrue et al., 2011; Lai et al., 2015; Sang & Bekhet, 2015; Sierzchula et al., 2014; Skippon & Garwood, 2011). Other previous studies found EV adoption to be negatively associated with perceptions of higher fuel costs (e.g., Buhler, Cocron, Neumann, Franke, & Krems, 2014; Graham-Rowe et al., 2012; Hoen & Koetse, 2014; Jensen et al., 2013), greater range anxiety (for a recent review, e.g., see Li et al., 2017), and less awareness of pro-environmental consequences of EV use (e.g., Axsen & Kurani, 2013; Barth et al., 2016; Burgess et al., 2013; Egbue & Long, 2012; Graham-Rowe et al., 2012; Noppers et al., 2014; Skippon & Garwood, 2011). We found those same relations when examining each predictor individually in predicting resistance, but those relations disappeared in a multivariate regression. Thus, the discrepancies between the present findings and past evidence regarding these variables may be the result of controlling for other causes in the present analyses.

Prior to the current investigation, published studies reported contradictory evidence regarding the impact of first-hand or second-hand experience on purchasing of EVs. On the one hand, Thogersen and Ebsen (2019) found that experience with EVs made attitudes toward EVs more favorable and lessened purchase resistance. But after Jensen and colleagues (Jensen, Cherchi, & de Dios Ortuzar, 2014; Jensen et al. (2013) gave research participants the opportunity to drive EVs for three months, this decreased interest in purchasing such vehicles. The present investigation adds to this confusion by showing that direct and vicarious experience had no mere-exposure-like influence on resistance to EV adoption. Clearly, future research should explore why these findings might seem to contradict one another.

5.2. Representative sampling of an entire nation's population

No past study of EV adoption or intentions to do so has examined a truly random, fully representative sample of the adult population of any country and instead relied on convenience samples (Barbarossa et al., 2015; Jansson et al., 2017; Jensen et al., 2014; Jensen et al., 2013; Priessner et al., 2018; Thogersen & Ebsen, 2019). In contrast, the present research relied on survey data gathered from individuals selected via true random sampling of the American adult public, which has a number of benefits. First, probability samples are more accurate than convenience samples when describing the attributes of a population (e.g., MacInnis, Krosnick, Ho, & Cho, 2018; Yeager et al., 2011; for a review, see Cornesse, Blom, Dutwin, et al., 2020). This justifies confidence that the distributions of variables observed in the present study accurately characterize the American public. Furthermore, relationships between variables often differ considerably between random samples and convenience samples (e.g., Malhotra & Krosnick, 2007; Pasek & Krosnick, 2020; Zack, Kennedy, & Long, 2019). Use of true random sampling in the present study justifies confidence that the observed relations of predictors to EV resistance provide valid descriptions of Americans' reasoning in this arena.

5.3. Practical implications

The findings reported here can be useful to elected representatives if they wish to address their constituents' concerns. Recently, new legislation has been proposed at federal and state levels seeking to accelerate the expansion of EV use in the U.S. For example, President Biden signed an executive order in August 2021, setting a target to make half of all new cars and trucks sold in the U.S. in 2030 EVs (Davenport, 2021). And California was the first state to require all light-duty vehicles in the state to emit zero emissions by 2030 (Bonifacic, 2021). In addition, a series of programs and funds to enhance the nation's EV infrastructure, focused on expanding the network of charging stations, were established by the passage of the Bipartisan Infrastructure Law (The White House, 2021). These programs will address some of the non-financial instrumental considerations identified in the present study that influence consumer resistance, so we may expect to see such resistance decrease as a result.

The findings on normative considerations, measured by awareness of needs and awareness of consequences, have implications for climate change communication. Respondents who believed that unchecked global warming will be more threatening were less resistant to EVs, so convincing people that global warming is a serious problem might decrease resistance. Thus, public education enhancing awareness of needs for EV adoption regarding climate change is likely to yield an expansion of the EV market.

It is important to note, however, that adoption of EVs will not in itself reduce future global warming. This effect will follow from increased EV purchasing only if the electricity used to run EVs is made from renewable sources. Yet the vast majority of electricity being made in the U.S. is instead made from burning fossil fuels. Thus, resistance to EV purchasing is likely to be reduced most effectively after sources of electricity shift more toward renewables, and only if the public learns about this shift.

5.4. Limitations and future research directions

The present study has several limitations. For example, it examined a limited number of categories of considerations potentially influencing EV resistance: two normative considerations and seven instrumental considerations. There are many other such considerations to be examined, so future research may broaden the range of these considerations. For example, social norms have been implicated as a potentially strong determinant of pro-environmental behavioral intent (e.g., Klockner & Blobaum, 2010), but social norms were not explored here. They can be in future studies.

Furthermore, even within the categories of predictors of EV resistance examined, the present investigation did not examine all possible predictors that have been explored in prior studies and did not include all the predictors implicated by rational choice theory, the TRA/TPB, the TAM, and the NAM. The particular predictors examined here were

chosen based upon intuitions about which would be most powerful. Future studies with sufficient budgets to allow for longer questionnaires might consider measuring a wider range of predictors within the categories examined here.

Future research can also enhance measurement of the variables studied. The present investigation operated on a fixed budget and measured each construct of interest with a single survey question, so that the breadth of constructs measured could be as wide as possible. But using single indicators means that measurement error was not minimized the way multiple indicators can (e.g., Blalock, 1970; Curtis & Jackson, 1962; Groves, 1989; Hagedoorn & Cloodt, 2003; Hayduk & Littay, 2012). Future research should employ multiple measures per construct. Most likely, the associations observed here will be strengthened when measurement error is minimized. However, the design of the individual questions used in the present investigation conformed to best practices in questionnaire design (e.g., Krosnick, 1999a, 1999b; Krosnick & Presser, 2010; Lietz, 2010; Pasek & Krosnick, 2010; Vannette & Krosnick, 2018; White et al., 2005), so the increase in predictive strength that may follow from the use of multiple indicators may be modest.

Another limitation of the present study is that the data were collected at the peak of the unprecedented public health crisis and economic hardships brought about by the COVID-19 pandemic. American perceptions of and resistance to EVs may differ under alternative economic and political circumstances or in response to varying events, such as public debates and deliberation, climate campaigns and education, and political landscape shifts. The pandemic certainly enhanced people's concern about public health and the economy (e.g., Jones, 2021; Pew Research Center, 2021). According to the Finite Pool of Worry theory (Weber, 2006), when people worry more about such issues, they worry less about others. And climate change may be one of the issues that people worried less about at the height of the COVID crisis when the present survey was conducted (but see Evensen et al., 2021). Future studies might explore the robustness of the present findings when national and international crises are not ongoing.

6. Conclusion

The findings reported here have valuable implications for the development of a conceptual framework explaining resistance to EV adoption specifically and the development of theories of the causes of pro-environmental behaviors more generally. The present study demonstrated that theories from economics and psychology identify potent reasons for pro-environmental behaviors. That both economic and psychological theories help to explain pro-environmental behaviors in the context of EVs suggests that these theories should be viewed not as competitors but rather as complementary. Future research can fruitfully explore the robustness of the predictive effects identified here and can be particularly helpful in investigating the instances in which theory-based predictions are borne out in studies of pro-environmental behaviors other than EV adoption. In the meantime, the present findings identify areas in which public outreach and education might effectively reduce resistance to consider purchasing EVs in the future.

Ethics review

This research was reviewed and approved by the Institutional Review Board of Stanford University.

CRediT authorship contribution statement

Bo MacInnis: Conceptualization, Formal analysis, Methodology, Data curation, Writing – original draft, Writing – review & editing. **Jon A. Krosnick:** Conceptualization, Formal analysis, Funding acquisition, Methodology, Supervision, Writing – original draft, Writing – review & editing. **Jared McDonald:** Writing – review & editing.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvp.2023.102114.

References

Abell, P. (2000). Sociological theory and rational choice theory. *The Blackwell Companion Soc. Theory, 2*, 223–244.
Abramson, J., & Desai, S. (1993). Purchase involvement of new car buyers: A descriptive study. *American Journal of Business, 2*(8), 13–22.
Adepetu, A., & Keshav, S. (2015). The relative importance of price and driving range on electric vehicle adoption: Los Angeles case study. *Transportation, 44*, 353–373.
Ajzen, I. (1985). From intentions to action: A theory of planned behavior. In J. Kuhl, & J. Beckman (Eds.), *Action control: From cognitions to behaviors* (pp. 11–39). New York: Springer.
Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179–211.
Alwin, D. F. (1988). Measurement and the interpretation of coefficients in structural equation models. In J. S. Long (Ed.), *Common problems/proper solutions: Avoiding error in quantitative research. Beverly hills, calif*. Sage.
APA (American Psychological Association). (2006). Report of the APA task force on socioeconomic status. http://www.apa.org/pi. March 1, 2023.
Axsen, J., & Kurani, K. S. (2013). Connecting plug-in vehicles with green electricity through consumer demand. *Environmental Research Letters, 8*(1), 1880–1885.
Barbarossa, C., Beckmann, S. S., De Pelsmacker, P., Moons, I., & Gwozdz, W. (2015). A self-identity based model of electric car adoption intention: A cross-cultural comparative study. *Journal of Environmental Psychology, 42*, 149–160.
Barth, M., Jugert, P., & Fritsche, I. (2016). Still underdetected – social norms and collective efficacy predict the acceptance of electric vehicles in Germany. *Transportation Research Part F, 37*, 64–77.
Beck, M. J., Rose, J. M., & Greaves, S. P. (2017). I can't believe your attitude: A joint estimation of best worst attitudes and electric vehicle choice. *Transportation, 44*, 753–772.
Biden, J. (2020). The Biden plan for a clean energy revolution and environmental justice. https://joebiden.com/climate-plan/#. on October 7, 2020.
Blalock, H. M. (1970). Estimating measurement error using multiple indicators and several points in time. *American Sociological Review, 35*(1), 101–111.
Bonifacic, I. (2021). California makes zero-emission autonomous vehicles mandatory by 2030. *Tech Crunch+*. September 24, 2021 https://techcrunch.com/2021/09/24/california-makes-zero-emission-autonomous-vehicles-mandatory-by-2030/. September 25, 2021.
Buhler, F., Cocron, P., Neumann, I., Franke, T., & Krems, J. F. (2014). A German field study. *Transportation Research Part F, 25*, 34–49.
Burgess, M., King, N., Harris, M., & Lewis, E. (2013). Electric vehicle drivers' reported interactions with the public: Driving stereotype change? *Transportation Research Part F, 17*, 33–44.
Cohen, J., & Cohen, P. (1975). *Applied Multiple Regression/Correlation Analysis For the Behavioral Sciences* (p. Erlbaum). Hillsdale.
Cornesse, C., Blom, A. G., Dutwin, D., Krosnick, J. A., De Leeuw, E. D., Legleye, S., et al. (2020). A review of conceptual approaches and empirical evidence on probability and nonprobability sample survey research. *J. Surv. Stat. Methodol., 8*(1), 4–36.
Curtis, R. F., & Jackson, E. F. (1962). Multiple indicators in survey research. *American Journal of Sociology, 68*(2), 195–204.
Davenport, C. (2021). *Biden, in a push to phase our gas cars, tightens polluyion rules*. New York Times. August 5, 2021. Accessed at https://www.nytimes.com/2021/08/05/climate/biden-tailpipe-emissions-electric-vehicles.html. on August 6, 2021.
Davis, F. D. (1986). A technology acceptance model for empirically testing new end-user information systems: Theory and results. In *Doctoral dissertation*. Cambridge, MA: MIT Sloan School of Management.
Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340.
Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*, 982–1003.
Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology, 22*(14), 11–32.
Desilver, D. (2021). Today's electric vehicle market: Slow growth in U.S., faster in China, Europe. https://www.pewresearch.org/fact-tank/2021/06/07/todays-electric-vehicle-market-slow-growth-in-u-s-faster-in-china-europe/. December 17, 2021.
EEI (Edison Electric Institute). (2019). *Electric vehicles sales: Facts & figures*. October 2019.

Egbue, O., & Long, S. (2012). Barriers to widespread adoption of electric vehicles: An analysis of consumer attitudes and perceptions. *Energy Policy, 48*, 717–729.
Eisenstein, P. A. (2019). Detroit's big three automakers are looking to a better-powered future, but each is forging its own path. *CNBC*. December 8, 2019 https://www.cnbc.com/2019/12/08/us-automakers-look-to-a-battery-powered-future-but-forge-their-own-paths.html. December 9, 2019.
EPA. (2020). Inventory of US greenhouse gas emissions and sinks | US EPA. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks. October 15, 2020.
Evensen, D., Whitmarsh, L., Bartie, P., Devine-Wright, P., Dickie, J., Varley, A., … Mayer, A. (2021). Effect of "finite pool of worry" and COIVD-19 on UK climate change perception. *Proceedings of the National Academy of Sciences, 118*(3), Article e2018936118.
Fazio, R. H., & Zanna, M. P. (1981). Direct experience and attitude-behavior consistency. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 14, pp. 161–202). New York, NY: Academic Press.
Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.
Foldy, B. (2020a). *Auto makers charge ahead with electric-vehicle plans*. July 19, 2020 https://www.wsj.com/articles/auto-makers-charge-ahead-with-electric-vehicle-plans-11595156400. July 20, 2020.
Foldy, B. (2020b). Auto makers grapple with battery-fire risks in electric vehicles. *Wall Street Journal*. October 19, 2020 https://www.wsj.com/articles/auto-makers-grapple-with-battery-fire-risks-in-electric-vehicles-11603099800. July 20, 2021.
Friedman, M. (1953). *Essays in positive economics*. Chicago: University of Chicago Press.
Graham-Rowe, E., Gardner, B., Abraham, C., Skippon, S., Dittmar, H., Hutchins, R., et al. (2012). Mainstream consumers driving plug-in battery-electric and plug-in hybrid electric cars: A qualitative analysis of responses and evaluations. *Transportation Research Part A, 46*(1), 140–153.
Groves, R. M. (1989). *Survey errors and survey costs*. New York: Wiley.
Hackbarth, A., & Madlener, R. (2013). Consumer preferences for alternative fuel vehicles: A discrete choice analysis. *Transportation Research Part D, 25*, 5–17.
Hackbarth, A., & Madlener, R. (2016). Willingness-to-pay for alternative fuel vehicle characteristics: A stated choice study for Germany. *Transportation Research Part A, 85*, 89–111.
Hagedoorn, J., & Cloodt, M. (2003). Measuring innovative performance: Is there an advantage in using multiple indicators? *Research Policy, 32*, 1365–1379.
Hayduk, L. A., & Littay, L. (2012). Should researchers use single indicators, best indicators, or multiple indicators in structural equation models? *BMC Medical Research Methodology, 12*, 159–175.
Heise, D. R. (1972). Employing nominal variables, induced variables, and block variables in path analyses. *Sociological Methods & Research, 1*(2), 147–173.
Hidrue, M. K., Parsons, G. R., Kempton, W., & Gardner, M. P. (2011). Willingness to pay for electric vehicles and their attributes. *Resource and Energy Economics, 33*(3), 686–705.
Hoen, A., & Koetse, M. J. (2014). A choice experiment on alternative fuel vehicle preferences of private car owners in The Netherlands. *Transportation Research Part A, 61*, 199–215.
International Energy Agency. (2022). Global EV outlook: Securing supplies for an electric future. https://iea.blob.core.windows.net/assets/ad8fb04c-4f75-42fc-973a-6e54c8a4449a/GlobalElectricVehicleOutlook2022.pdf. March 1, 2023.
Jansson, J., Nordlund, A., & Westin, K. (2017). Examining drivers of sustainable consumption: The influence of norms and opinion leadership on electric vehicle adoption in Sweden. *Journal of Cleaner Production, 154*, 176–187.
Jensen, A. F., Cherchi, E., & de Dios Ortuzar, J. (2014). A long panel survey to elicit variation in preferences and attitudes in the choice of electric vehicles. *Transportation, 41*(5), 973–993.
Jensen, A. F., Cherchi, E., & Mabit, S. L. (2013). On the stability of preferences and attitudes before and after experiencing an electric vehicle. *Transportation Research Part D, 25*, 24–32.
Jones, J. M. (2021). Economic concerns hit pandemic high; still low historically. https://news.gallup.com/poll/357617/economic-concerns-hit-pandemic-high-low-historically.aspx. March 1, 2023.
Kahneman, D. (2003). Maps of bounded rationality: Psychology for behavioral economics. *The American Economic Review, 93*(5), 1449–1475.
Klockner, C. A. (2013). A comprehensive model of the psychology of environmental behaviour – a meta-analysis. *Global Environmental Change, 23*, 1028–1038.
Klockner, C. A., & Blobaum, A. (2010). A comprehensive action determination model: Toward a broader understanding of ecological behaviour using the example of travel mode choice. *Journal of Environmental Psychology, 30*(4), 574–586.
Kolodny, L. (2020). Biden and Trump agreed on at least one thing in debate: Support for electric vehicles. https://www.cnbc.com/2020/09/30/trump-and-biden-both-say-they-support-electric-vehicles-in-debate.html. October 7, 2020.
Krosnick, J. A. (1991). Response strategies for coping with the cognitive demands of attitude measures in surveys. *Applied Cognitive Psychology, 5*, 213–236.
Krosnick, J. A. (1999a). Maximizing measurement quality: Principles of good questionnaire design. In J. P. Robinson, P. R. Shaver, & L. S. Wrightsman (Eds.), *Measures of political attitudes*. New York: Academic Press.
Krosnick, J. A. (1999b). Survey research. *Annual Review of Psychology, 50*, 537–567.
Krosnick, J. A., & MacInnis, B. (2020). *Climate insight: Overall trends*. Washington DC: Resources for the Future.
Krosnick, J. A., Narayan, S. S., & Smith, W. R. (1996). Satisficing in surveys: Initial evidence. *New Directions for Evaluation, 70*, 29–44.
Krosnick, J. A., & Presser, S. (2010). Questionnaire design. In J. D. Wright, & P. V. Marsden (Eds.), *Handbook of survey research* (2nd ed.). West Yorkshire, England: Emerald Group.
Lai, I., Liu, Y., Sun, X., Zhang, H., & Xu, W. (2015). Factors influencing the behavioural intention towards full electric vehicles: An empirical study in Macau. *Sustainability, 7*(9), 12564–12585.
Levin, J., & Milgrom, P. (2004). Introduction to choice theory. https://web.stanford.edu/~jdlevin/Choice. August 12, 2022.
Lietz, P. (2010). Research into questionnaire design - a summary of the literature. *International Journal of Market Research, 52*(2), 249–272.
Li, W., Long, R., Chen, H., & Geng, J. (2017). A review of factors influencing consumer intentions to adopt battery electric vehicles. *Renewable and Sustainable Energy Reviews, 78*, 318–328.
MacInnis, B., Krosnick, J. A., Ho, A. S., & Cho, M. (2018). The accuracy of measurements with probability and nonprobability survey samples: Replication and extension. *Public Opinion Quarterly, 82*(4), 707–744.
Malhotra, N., & Krosnick, J. A. (2007). The effect of survey mode and sampling on inferences about political attitudes and behavior: Comparing the 2000 and 2004 ANES to Internet surveys with nonprobability samples. *Political Analysis, 15*(3), 286–323.
Nayum, A., & Klockner, C. A. (2014). A comprehensive socio-psychological approach to car type choice. *Journal of Environmental Psychology, 40*, 401–411.
Noppers, E. H., Keizer, K., Bolderdijk, J. W., & Steg, L. (2014). The adoption of sustainable innovations: Driven by symbolic and environmental motives. *Global Environmental Change, 25*, 52–62.
Pasek, J., & Krosnick, J. A. (2010). Optimizing survey questionnaire design in political science: Insights from psychology. In J. Leighley (Ed.), *Oxford handbook of American elections and political behavior*. Oxford, UK: Oxford University Press.
Pasek, J., & Krosnick, J. A. (2020). Relations between variables and trends over time in RDD telephone and nonprobability sample Internet surveys. *J. Surv. Stat. Methodol., 8*(1), 37–61.
Pew Research Center. (2021). A year of U.S. Public opinion on the coronavirus pandemic. https://www.pewresearch.org/2021/03/05/a-year-of-u-s-public-opinion-on-the-coronavirus-pandemic/. March 1, 2023.
Priessner, A., Sposato, R., & Hampl, N. (2018). Predictors of electric vehicle adoption: An analysis of potential electric vehicle drivers in Austria. *Energy Policy, 122*, 701–704.
Regan, D. T., & Fazio, R. (1977). On the consistency between attitudes and behavior: Look to the method of attitude formation. *Journal of Experimental Social Psychology, 13*, 28–45.
Riley, C. (2019). *The great electric car race is just beginning*. CNN Business. August 2019 https://www.cnn.com/interactive/2019/08/business/electric-cars-audi-volkswagen-tesla/. August 31, 2019.
Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York: The Free Press.
Sang, Y., & Bekhet, H. A. (2015). Modelling electric vehicle usage intentions: An empirical study in Malaysia. *Journal of Cleaner Production, 92*, 75–83.
Schmalfuss, F., Muhl, K., & Krems, J. F. (2017). Direct experience with battery electric vehicles (BEVs) matters when evaluating vehicle attributes, attitude and purchase. *Transportation Research Part F, 46*, 47–69.
Schwartz, S. H. (1977). Normative influences on altruism. *Advances in Experimental Social Psychology, 10*, 221–279.
Schwartz, S. H., & Howard, J. A. (1981). A normative decision-making model of altruism. In P. J. Rushton, & R. M. Sorrentino (Eds.), *Altruism and helping behavior: Social, personality, and developmental perspectives* (pp. 189–211). Hillsdale, NJ: Lawrence Erlbaum.
Schwarz, N. (1995). Social cognition: Information accessibility and use in social judgment. In E. E. Smith, & D. N. Osherson (Eds.), *Thinking: An invitation to cognitive science* (3, pp. 345–376). Cambridge, MA: MIT Press.
Sierzchula, W., Bakker, S., Maat, K., & van Wee, B. (2014). The influence of financial incentives and other socio-economic factors on electric vehicle adoption. *Energy Policy, 68*, 183–194.
Simon, H. (1955). A behavioral model of rational choice. *Quarterly Journal of Economics, 69*(1), 99–118.
Skippon, S., & Garwood, M. (2011). Responses to battery electric vehicles: UK consumer attitudes and attributions of symbolic meaning following direct experience to reduce psychological distance. *Transportation Research Part D, 16*(7), 525–531.
Smith, A. (1776). The wealth of nations. Oxford, England: Bibliomania.com Ltd.
Taylor, S., & Todd, P. (1995). Understanding information technology usage: A test of competing models. *Information Systems Research, 6*(2), 144–176.
Thogersen, J., & Ebsen, J. V. (2019). Perceptual and motivational reasons for the low adoption of electric cars in Denmark. *Transportation Research Part F, 65*, 89–106.
Van Raaij, E. M., & Schepers, J. J. L. (2008). The acceptance and use of a virtual learning environment in China. *Computers & Education, 50*, 838–852.
Vannette, D. L., & Krosnick, J. A. (Eds.). (2018). *The Palgrave Handbook of Survey Research*. London, UK: Palgrave MacMillan.
Venkatesh, V. (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information Systems Research, 11*(4), 342–365.
Venkatesh, V., & Davis, F. D. (1996). A model of antecedents of perceived ease of use: Development and test. *Decision Sciences, 27*(3), 451–481.
Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46*(2), 186–204.
Venkatesh, V., Morris, M., Davis, G., & Davis, F. (2003). User acceptance of information technology: Towards a unified view. *MIS Quarterly, 27*(3), 479–501.
Venkatesh, V., Thong, J. Y. L., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS Quarterly, 36*(1), 156–178.
Weber, E. U. (2006). Experience-based and description-based perceptions of long-term risk: Why global warming does not scare us (yet). *Climatic Change, 70*, 103–120.

White House, T. (2021). Fact sheet: The Biden-Harris electric vehicle charging action plan. https://www.whitehouse.gov/briefing-room/statements-releases/2021/12/13/fact-sheet-the-biden-harris-electric-vehicle-charging-action-plan/. December 14, 2021.

White, P. C. L., Jennings, N. V., Renwick, A., & Barker, N. H. L. (2005). Questionnaires in ecology: A review of past use and recommendations for best practice. *Journal of Applied Ecology, 42*, 421–430.

Yeager, D. S., Krosnick, J. A., Chang, L., Javitz, H. S., Levendusky, M. S., Simpser, A., et al. (2011). Comparing the accuracy of RDD telephone surveys and internet surveys conducted with probability and non-probability samples. *Public Opinion Quarterly, 75*(4), 709–747.

Zack, E. S., Kennedy, J., & Long, J. S. (2019). Can nonprobability samples be used for social science research? A cautionary tale. *Survey Research Methods, 13*(2), 215–227.

Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology, 9*(2), 1–27.