Electrification of the Automotive Industry

Examining the moderating effect of electrified vehicles on the relationship between well-known brands' engagement in electrification and consumers' brand valuations & purchase behavior

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Dissertation written under the supervision of Professor Maria Sousa de Macedo Estarreja

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Abstract

In an urge to mitigate negative impacts of combustion engines on the environment in terms of air pollution, traffic noise, and health, governments across the globe are demanding innovations in the mobility sector. As a result, automobile manufacturers are fostering on e-mobility options to provide long-term solutions to the worrying development of climate change and traffic congestion. More precisely, automobile brands are introducing electrified vehicles to resolve above-mentioned environmental issues, as well as offering consumers an alleged sustainable choice to their current selection of vehicles. Using prior academic literature as a foundation, an experimental study was conducted to examine the effect of well-known automobile brands' engagement in electrification on consumers' brand valuations and purchase behavior, as well as to elaborate the role of the type of electrified vehicle as a moderator on named relationship. Results indicate that brands' engagement in electrification positively impacts perceived ethicality, brand image, brand trust, purchase intention and willingness to pay. Additionally, the type of electrified vehicle has a moderating effect on afore-mentioned relationship. Namely, electric vehicles and plug-in hybrid electric vehicles increase brand valuations and purchase behavior, whereas hybrid electric vehicles decrease those valuation metrics. Additionally, an extra analysis yields four regression models which evaluate purchase intention of electrified vehicles based on socio-demographic factors, where age and political orientation are found to have great predictive power. This study provides valuable theoretical and managerial implications towards automobile brands' engagement in electrification, emphasizing positive evaluation with regards to consumer perceptions of electrification and, more specific, electrified vehicles.

Keywords: Electrification, Automobile Brands, E-Mobility, Brand Valuation, Electric Vehicles, Plug-in Hybrid Electric Vehicles, Hybrid Electric Vehicles, Consumer Perceived Ethicality, Brand Image, Brand Trust, Brand Loyalty, Purchase Intention, Willingness to Pay.

Resumo

Para mitigar os impactos negativos dos motores de combustão no meio ambiente relacionados com poluição do ar, ruído do tráfego e saúde, vários governos exigem inovação no setor da mobilidade. As marcas de automóveis introduziram veículos elétricos para resolver as questões ambientais anteriormente mencionadas e ofereceram aos consumidores uma suposta seleção sustentável para a escolha de veículos. Com base em literatura científica, um estudo experimental foi conduzido para examinar o efeito do envolvimento de marcas de automóveis conhecidas na eletrificação nas avaliações de marca e comportamentos de compra dos consumidores, bem como para elaborar o papel do tipo de veículo eletrificado como moderador da relação mencionada. Os resultados indicam que o envolvimento das marcas na eletrificação impacta positivamente a ética, a imagem e a confiança da marca, tal como a sua intenção e disposição de compra. Também, o tipo de veículo elétrico tem um efeito moderador nesta relação. Ou seja, os veículos elétricos e os veículos elétricos híbridos plug-in melhoram as avaliações da marca e comportamentos de compra, enquanto os veículos elétricos híbridos diminuem estas métricas de avaliação. Além disso, uma análise extra produz quatro modelos de regressão que avaliam a intenção de compra de veículos eletrificados com base em fatores sociodemográficos, entre os quais a idade e orientação política apresentam grande poder preditivo. Este estudo fornece implicações teóricas para o envolvimento das marcas automóveis na eletrificação, enaltecendo uma avaliação positiva das perceções que o consumidor tem da eletrificação e, mais especificamente, dos veículos eletrificados.

Palavras-Chave: Eletrificação, Marcas de Automóveis, E-Mobilidade, Avaliação da Marca, Veículos Elétricos, Veículos Elétricos Plug-in, Veículos Elétricos Híbridos, Ética Percebida pelo Consumidor, Imagem de Marca, Confiança na Marca, Lealdade à Marca, Intenção de Compra, Disponibilidade para Pagar.

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Cheers!

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1. Introduction

1.1 Problem Definition and Relevance

As population and GDP growth drive car ownership and vehicle miles travelled, an urge to resolve the resulting mobility problems arose. Consequently, the mobility industry finds itself in an opportunistic transformation, mainly addressing three areas: regulation, consumer behavior, and technology (Cornet et al., 2021).

Narrowing the focus on Europe, 3.089.221 new vehicles were registered in the year 2020, a growth of 45% compared to 2019 (VDA, 2021). From those vehicles, electric car registrations made up 11%, accumulating to almost 350.000 vehicles (EEA, 2021). Putting the numbers into perspective, only 700 electrified vehicles were sold in 2010, underlining an increase of 49.900% in registrations over the last ten years. These figures are not only driven by consumer demand, but also by government regulations. Organizational theory suggests that the organizational field in which a company operates mediates the change named business undergoes (Wooten & Hoffman, 2017). As a result, Orsato & Wells (2007) point out that the broader organizational field of the automotive industry is shaped by corporate responses to the contemporary need for more sustainable practices which are in turn accelerated by government regulations.

Furthermore, consumer behavior also plays a crucial role in the current transformation of the automobile industry. Without consumers adopting to new vehicle technologies, the transformation would not be successful. A variety of studies were conducted which identified different aspects of electrified vehicle adoption to be relevant: environmental performance of the vehicles, consumers' perception, and personality, as well as financial incentives and charging infrastructure (He, Zhan & Hu, 2018, Sierzchula et al., 2014; Degirmenci & Breitner, 2017).

In addition to that, technological advancements over the last years allowed automobile manufacturers to produce more durable and range efficient electrified vehicles (Sun et al, 2020). Still, the lithium-ion batteries, which are used to store electricity in electrified vehicles, impose limitations on their application in terms of safety, durability, and high costs (Lu et al., 2013). Even though the number of electrified vehicle registration have increased, previous research on consumer adoption underlines skeptics towards e-mobility.

Consequently, previous studies have shown that the impact on the environment caused by electrified vehicles can potentially be as harmful as the impact of internal combustion engine vehicles (ICEVs) run with petrol. Juan & Mendez (2016) found that if the energy used to charge

electrified vehicles is not generated from renewable sources, the positive impact on the environment, in contrast to ICEVs, is mitigated.

As the change to alternative mobility, especially e-mobility, is ongoing and likely to continue, the consequences for automobile brands are yet to be explored. As there are arguably different perspectives one can take on the topic of electrification in the automobile industry, the impact this process has on consumer perceptions of automobile brands itself has not been examined and presents a gap in literature. In greater detail, the present study will focus on well-known automobile brands. This is due to consumers having different knowledge standards on the topic of electrification, especially electrified vehicles. But, as Hoefler & Keller (2003) stated, the knowledge gap in products can be mitigated by strong brands with greater consumer knowledge structures. Therefore, focusing on well-known brands will reduce biased responses during the studies conducted for this research.

Furthermore, Aaker (1991) and Brady (2020) underline the importance of brands to a company, as they prove them to be the greatest asset to any business. This has major implications on buying decisions of consumers, since Myers (2003) found brand equity and brand choice to be narrating factors of consumers' preference for high-involvement products. Consequently, automobile brands should aim at fostering their existing brand equity, since cars belong to the category of high-involvement products due to consumers infrequently buying them and hence, must protect and build their reputation to maintain, or even improve their position in the market.

Concluding, a change in the mobility industry concerning regulations, consumer behavior and technology is happening. The present study puts its focus on the electrification of the automobile and the subsequent effect it has on well-known automobile brands introducing those vehicles. Since brands must follow the transformation in the industry, they are exposed to the inevitably changing consumer perceptions. As mentioned before, electrification is a double-edged sword that can have a positive or negative effect on consumers' brand valuation, as well as their purchase behavior. Mainly, this study tries to understand the impact well-known brands' engagement in electrification has on consumers' valuations and purchase behavior of those brands, as well as to examine the moderating effect of the type of electrified vehicle a brand can introduce.

1.2 Objectives and Research Questions

The main objective of the present study is to investigate into the impact of well-known automobile brands engagement in electrification on consumers' brand valuations. Furthermore, the study aims at evaluating whether the type of electrified vehicle (Electric Vehicle, Hybrid Electric Vehicle, Plug-in Hybrid Electric Vehicle) moderates consumers' brand valuations and purchase behavior.

Hence, the first research question addresses the potential change in consumers' brand valuations (brand image, brand trust, brand loyalty, perceived ethicality, purchase intention & willingness to pay) as well-known automobile brands engage in electrification:

RQ1*: Does consumer valuation of well-known automobile brands increase following electrification?*

Next, the following research question aims at evaluating the moderating role of the type of electrified vehicle a well-known brand can introduce to their product portfolio on the relationship between engaging in electrification (vs. not) and consumers' brand valuations (perceived ethicality, brand image, brand trust, brand loyalty) and consumers' purchase behavior (purchase intention & willingness to pay).

RQ2*: Does the type of electrified vehicle moderate the relationship between brands' engagement in electrification and consumers' brand valuations and purchase behavior?*

1.3 Dissertation Structure

The present study follows the hereinafter posed structure: the first chapter introduces the reader to the research problem as well as the according objectives in the form of the research questions. The second chapter provides an overview of the relevant literature and concepts as to build a foundation of theory on which this research is built upon. Following, the third chapter presents the reader to the conceptual framework of the present study along with the hypotheses to the research questions derived from literature review. Thereafter, the methodologies and data collection methods used in the study are presented. The fifth chapter will thoroughly analyze the data collected, referring to the hypotheses developed in chapter three, concluding with a presentation of the results. Finally, the last chapter summarizes the main conclusions and provides the reader with theoretical and managerial implications. Moreover, limitations of the present study are pointed out and direction for further research is provided.

2. Literature Review

2.1 Electrification of the Automobile

A series of environmental, geo-political, economic, and social concerns related to the pollution and greenhouse gas (GHG) emissions of internal combustion engine vehicles (ICEVs) in the 20th century led automobile manufacturers to rethink their approach to vehicle production and fertilized the ground for new innovations in electric powered vehicles. (Emadi & Petrunić, 2014).

Emphasizing environmental and social aspects of above-mentioned change, negative externalities such as noise pollution, air pollution, and traffic congestion resulted in the transportation sector being accountable for more than 25% of world energy consumption, leading to an exponential increase in air contamination (Juan & Mendez, 2016). Further elaborating on the negative effects, especially concerning costs of those externalities, Korzhenevchy et. al (2014) evaluated those aforementioned costs to be accountable for about 8,5% of the GDP in regions such as the European Union. Thus, transportation activities portray one of the largest sources of CO2 emissions and hence, there is a strong interest in mitigating their effect. To bring these findings into perspective, two studies by Conway et. al (2012) and Browne & Allen (2011), analyzed the reduced impact on the environment by substituting ICEVs with electric vehicles (EVs) and electric tricycles in freight operations. It was found that, besides the total distance travelled and CO2 emissions per parcel delivered fell by 20% and 54%, respectively, CO2 emissions per parcel delivered were virtually eliminated. These findings underline the importance of EVs to environmental sustainability, as well as the contribution to improved air quality and noise reductions (Figliozzi, 2010). However, it must be noted that a switch to EVs is only reasonable, if the electricity generated to charge the vehicles has a low level of carbon production. Otherwise, an exchange of two pollutant technologies would not mitigate the negative effects on the environment (Juan & Mendez, 2016).

Currently, there are three different types of vehicles, that are powered (or partly powered) by an electric motor and hence can be described as "*electrified*". The "*electrification level*" of those vehicles varies and can be defined as the total percentage of a vehicle's electric power to its total power (Emadi & Petrunić, 2014).

First, hybrid electric vehicles (HEVs) are powered by an internal combustion engine in combination with one or more electric motors that use batteries to store and retrieve the energy (U.S. Department of Energy, n.d.). Batteries are charged from regenerative braking

technologies and vehicle acceleration with the help of the ICE. HEVs cannot be operated in a full-electric mode, since the electric motors are only supporting the ICE and cannot be operated independent from the combustion engine (Khaligh & Li, 2010).

Second, plug-in hybrid electric vehicles (PHEVs) are defined as an HEV containing a battery storage system of 4kWh or more. Further, other than the HEV, the batteries used to power the electric motor can be recharged from an external electric source and PHEVs can be operated in a full-electric mode for a minimum of 10 miles (Khaligh & Li, 2010).

Lastly, electric vehicles (EVs) have a pure electric propelling system that completely replaces the internal combustion engine. Just like the PHEV, an EV must be recharged from an external electric source (Khaligh & Li, 2010).

2.1.1 Regulations and the Economic Environment

Growing dependence on imported fuels and increasing pollution levels have urged governments around the globe to drift away from fossil fuel-based vehicles to electrified vehicles (Robinson & Tummalapalli, 2018). Lane et. al (2013) found that governments of various countries have different incentives to promote EV policies. Interestingly, they explained the promotion of electrified vehicles mostly due to industrial policy, emphasizing the economic aspect of such policies to maintain a competitive position in the global marke. On the other hand, the objective of reducing pollution levels (as pictured for the U.S.), is addressed through the regulation of other elements of the energy sector, namely processes like fuel refining (Lane et. al 2013). Furthermore, little research on financial incentives (tax reductions) and non-financial incentives (free/preferred parking) has been undertaken to gain insights on their importance and impact on EV adoption (Coffman, Bernstein & Wee, 2017). Mostly, government incentives for electric vehicles have an economic nature. However, a common goal in government policies is to reduce GHG emissions and incentives consumers to diffuse from ICEVs to electrified vehicles.

2.1.2 Paradox of Electrification

Although EVs do not produce any emissions while driving, one must understand the production process, as well as the energy supply produce an extensive number of emissions. Scholars have found, depending on the electricity generation mix, that GHG emissions of EVs are not necessarily lower, than GHG emissions of ICEVs. Woo, Choi, & Ahn (2017) calculated the GHG emissions produced by ICEVs and EVs based on the well-to-wheel method. Interestingly, EVs that are powered by electricity that is generated by oil and coal are found to produce higher

GHG emissions than diesel- and gasoline powered ICEVs. Additionally, when comparing the life-cycle emissions of EVs and ICEVs, one can find that the production process, especially the production of lithium-ion batteries that power EVs, produces more emissions than the production of ICEVs. However, taking the life cycle of both vehicles into account, EVs eventually produce less emissions since they have zero tailpipe emissions (Rangaraju, De Vroey, Messagie, Mertens & Van Mierlo, 2015). Generally, electrified vehicles produce less emissions on the road than regular ICEVs. However, overall emissions depend on the electricity mix from which energy to power the vehicle is derived, as well as the life cycle of the vehicle which must be great enough to mitigate the emissions from production processes.

2.1.3 Consumer Adoption of Electric Vehicles

With electrification happening in the automobile industry, many studies are focusing on consumers' attitude and perception towards the adaption of electrified vehicles. Degirmenci & Breitner (2017) investigated the role of environmental performance compared to price value and range confidence regarding consumers' purchase intention for EVs. They found environmental performance of an EV is indeed a stronger determinant of attitude and hence purchase intention than price value and range confidence. However, as pointed out before, this assumption only holds true if the electricity used to power the vehicles is produced from renewable energy sources to make EVs a true green alternative to ICEVs. Another study by He, Zhan & Hu (2018) proposes a personality-perception-intention framework to understand consumers' EV adoption behavior. The framework shows that consumers' perception (separated in positive- and negative utility) and personality (environmental concern & personal innovativeness) are major determinants of purchase intention towards EVs. Additionally, Sierzchula et al. (2014) conducted a study in 30 countries to examine the extent financial incentives and other socio-economic factors explain EV adoption. Interestingly, they found financial incentives and charging infrastructure explaining 2/3 of EV adoption in their model, while socio-demographic variables (such as education level, income etc.) are no good predictors of adoption level. However, scholars are mainly focusing on the adoption of electric vehicles rather than examining the impact of electrification on brands itself. No conclusive research has been conducted regarding the influence of brands in this construct. Hence, this paper examines the impact of electrification of automotive brands on consumers' brand valuations and consumers' buying behavior.

2.2 Consumers' Brand Valuations and Purchase Behavior

2.2.1 Brand Valuations

Importance of strong brands in the context of electrification

Electrification of a car brand involves brand extension, more specifically, product line extension and hence presents new information to the consumers about a brand. This information could have a tremendous impact on brand valuations, due to the success or failure of named extension. Previous symbolic associations of the brand (pre-extension) are the foundation on which consumers evaluate the brand. Keller and Lehmann (2006) found extensions to be most successful if consumers relate to the new products and perceive them as a good fit to the brand. Further, established brands that engage in product-line extension seem to benefit from facilitative effects that foster retrievability of parent brand information. Brands frequently use sub-branding strategies to facilitate consumers' evaluations of those extensions and to mitigate parent brand dilution effects. (Milberg et. al 1997; Sood & Keller, 2004). Especially in the automotive industry, brands like BMW and Mercedes-Benz established sub-brands (BMW i & Mercedes-EQ, respectively) to introduce their e-mobility options (BMW Group, 2011; Daimler AG, 2021). Establishing sub-brands connects the newly introduced electrified vehicles to the parent brand and aims at fostering existing brand equity. On the other hand, if product-line extension fails, sub-branding mitigates negative effects on parent brands. Moreover, parent brand advertising in a scenario of brand extension has been found to be more impactful than specifically advertising the product-line extension (Morrin, 1999). The established image and brand awareness of a certain brand that engages in brand extension cannot be neglected. Consequently, the associative network theory by Anderson (1983) conceptualizes the interconnection between stored concepts and the respective strength of the connection between the concepts. Hence, brand knowledge can be described as a brand node with a network built around it. Further evaluating on this concept, brand knowledge is the foundation of brand equity, as conceptualized in the Brand Resonance Pyramid by Keller (2009). Thus, if consumers do not hold strong, unique, and favorable associations with a brand and this brand engages in extension of its product line, consumers' brand valuations could be diluted, and the products neglected. Brand equity is a crucial concept to understand when moving forward with brand valuations. Positive brand valuations can only be achieved with high brand equity and this research indirectly evaluates the impact of product-line extension on brand equity and hence, brand valuations.

Brand Image

To analyze the impact on brand valuations and buying behavior, one must first understand the impact brands have on consumers and their respective buying behavior, especially in high-involvement product categories. Mühlbacher et al. (2016) point out that, in high-involvement product categories, brand strength is formed by consumers' having unique brand associations, as well as a high level of familiarity, underlining the importance of branding towards high brand strength. Level of involvement with a product varies among consumers, but in the case of automobiles, scholars examined those products to be specifically more involving than other product categories (Clarke & Russell, 1979; Lastovicka & Gardner, 1978) because they tend to be more brand differentiated, higher in monetary value and hence, less frequently purchased (Lastovicka, 1979). Furthermore, in the case of EVs, Heffner et al. (2007) show that self-image is reinforced by brands. This holds true, even when consumers are only partly knowledgeable in a certain subject (e.g., people buying electric cars because they want to reduce their negative impact on the environment is more linked to the person's impression to be more ethical in contrast to others). However, no conclusive study examined this concept the other way around. It remains to be investigated whether alleged environmental friendly actions undertaken by a brand do have an influence on brand image and hence, self-image of consumers buying the brand.

Moreover, consumers rely on shortcuts in their decision-making process, namely, imperfect information. This brings importance to the perceived quality of a brand which can reduce risk and search cost for potential buyers (Baltas & Saridakis, 2010). This underlines that car brands that have a reputation of producing high quality vehicles are more likely to be valuated higher by consumers than brands that are perceived as low-quality manufacturers, indicating that regardless of the level of electrification of a brand, previous quality perception has a major influence on consumers' brand valuations. However, the consequences of automobile brands' engagement in electrification on consumer valuations remain unexplored and thus, present the author with a gap in literature that must be further examined.

Consumer Perceived Ethicality (CPE)

With automotive brands introducing an increasing number of electrified vehicles to the market, they are aiming at improving their pro-environmental reputation, as well as communicating ethicality in their actions. Brunk (2010) defines six domains of consumer perceived ethicality (CPE): consumers, employees, the environment, the overseas community, the local economy

and community, and the business community. Scholars have found CPE to be more diverse and complex than initially pictured, due to the increasing importance of pro-environmental topics and ethical issues highlighted in the media. In fact, positive CPE leads to an increased evaluation of brand affect and brand trust, examining a direct relationship between CPE and perception of brands (Singh, Iglesias & Batista-Foguet, 2012). Since CPE has gained traction in recent years and electrification of the automotive industry is a double-edged sword, this research will evaluate whether consumers perceive brands producing electrified vehicles as more noble and ethical.

Brand Trust

Brand trust, as defined by Munuera-Aleman, Delgado-Ballester & Yague-Guillen (2003), is the "feeling of security held by the consumer in his/her interaction with the brand, that it is based on the perceptions that the brand is reliable and responsible for the interests and welfare of the consumer". Brand trust is therefore established by brands that are giving security and responsibility to their actions without misleading consumers with false information about their intentions. For this study, brand trust consists of two dimensions: direct (usage) and indirect (advertising) consumer's evaluations (Keller, 1993). In the case of electrification of automotive brands, trust is established when consumers positively evaluate their consumption experiences (direct and indirect) with the brand and reflect on them with loyalty towards the brand. It remains to be examined how consumers' consumption experiences (direct or indirect) with electrified vehicles impact their respective brand valuations.

Brand Loyalty

The concept of brand loyalty, as described by Tucker (1964), refers to biased choice behavior of consumers. It accumulates to the relative frequency a consumer choses one product over another, when presented with two identical products. On the other hand, more recent studies put their emphasis on the concept of attitudinal loyalty, and not so much on behavioral loyalty (Bandyopadhyay & Martell, 2007). Attitudinal loyalty underlines the psychological commitment a consumer unveils when making a purchase, without taking the biased choice behavior into account (Jacboy, 1971). However, brand loyalty was found to have a direct effect on brand equity as loyal consumers are less likely to purchase products from other brands and therefore positively influence brands' return on investment (Gounaris & Stathakopoulos, 2004).

As prior literature on electrification is torn between the positive and possible negative effects of such (Woo et al., 2017; Rangaraju et al., 2015), it remains to be explored whether and how brand loyalty of automobile brands is impacted.

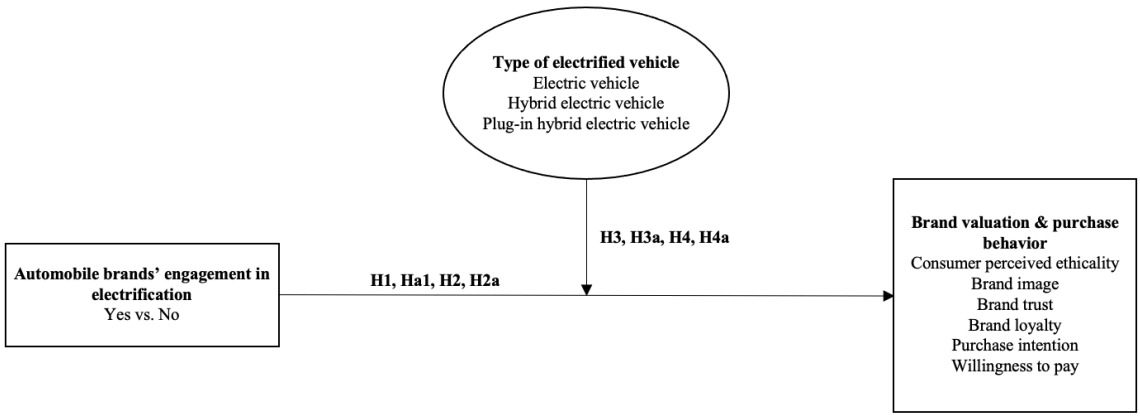
2.2.2 Purchase Behavior

Research on purchase behavior of sustainable products led to several theories and models. Starting with the theory of planned behavior (Ajzen, 1991), intention to perform a certain behavior is narrated by attitude, perceived behavioral control and subjective norm, and intention then leads to actual behavior. Applying this theory to consumers' purchase behavior of pro-environmental products, Pelsmacker, Moons and Barvarossa (2016) evaluated intentions to purchase EVs (regarded as pro-environmental behavior and thus ethical consumer behavior) based on green self-identity (GSI), environmental concern (EC), and green moral obligation (GMO). Results showed that GSI has a significant impact on the intention to purchase an EV, with EC being the stronger moderator than GMO. This implies that green moral obligations among consumers are still weak and most purchase behavior of EVs come from consumers already having a "green" attitude and follow the norms of green consumerism. To translate these findings onto the scope of this research, valuations of brands' electrification behavior will likely be more appreciated by consumers who already identify with sustainable and environmentally friendly lifestyles, as well as a concern for the environment. To facilitate, the norm-activation model by Schwartz (1977) tries to explain pro-environmental behavior based on three different types of antecedents: awareness of consequences, ascription of responsibility and personal norm. Consumers not being aware of the consequences of their actions on the environment, their societal responsibility and lastly their intrinsic motivations for a more sustainable lifestyle are less likely to engage in pro-environmental behavior. To further elaborate, it has been found that consumer emotions directly influence their (purchasing) behavior. In fact, positive anticipated emotions enforce pro-environmental behavior, whereas negative anticipated emotions are being an obstacle in consumer adoption of EVs (Rezvani, Jansson & Bengtsson, 2017, Rezvani, Jansson & Bengtsson, 2018). This underlines the importance of emotions in adoption of electric vehicles and, again, can be translated to the brand perspective. Consumers feeling emotionally connected to brands that promote sustainable practices are more likely to attribute higher valuations towards the specific brand. However, no conclusive research has been conducted on automobile brands' efforts towards sustainable practices and the respective effect they have on consumers' brand valuations and purchase behavior, presenting a gap in prior research which remains to be explored.

3. Conceptual Model and Hypotheses

This research aims to evaluate automobile brands' engagement in electrification on consumers' brand valuations and purchase intentions. An experimental study will be conducted to examine the impact of a brands' engagement in electrification (vs. not), namely the independent variable of the study, on various dimensions of consumers' brand valuations and purchase behavior, namely the dependent variables that are: consumer perceived ethicality, brand image, brand trust, brand loyalty, purchase intention and willingness to pay. In addition to that, the moderating effect of the different type of electrified vehicle (EV, HEV, PHEV) on the above-mentioned dependent variables will be evaluated. Furthermore, consumers own ecological consciousness will be implemented into the model as a covariate.

Figure 1 - Conceptual Model



Hypotheses:

According to the examined literature, automobile brands' engagement in electrification is driven by governmental regulations and environmental concerns alike (Lane et. al, 2013). However, those concerns of mitigating the negative externalities of internal combustion engine vehicles are not only driven by government regulations, but also by changing consumer demands towards a more environmentally friendly transportation sector (Korzhenevchy et. al, 2014). With the examined importance of electrified vehicles to environmental sustainability (Figliozzi, 2010), it seems that automobile brands are directly impacted by engaging in electrification. Thus, the following hypotheses are proposed:

H1: Well-known automobile brands' engagement in electrification will influence consumers' brand valuations.

H1a: Well-known automobile brands' engagement in electrification will positively affect consumers' brand image, brand trust, brand loyalty and perceived ethicality.

This does not only hold true for consumers' valuations of well-known automobile brands, but also for consumers' purchase behavior. Heffner et al. (2017) point out that self-image is reinforced by brands and hence by the products that are bought from the respective brands. Therefore, the following hypotheses are proposed:

H2: Well-known automobile brands' engagement in electrification will influence consumers' purchase behavior.

H2a: Well-known automobile brands' engagement in electrification will positively affect consumers' purchase intention and willingness to pay.

Afore mentioned literature suggests that electrified vehicles, which place a focus on environmental performance, have a positive impact on consumers' purchase behavior of such vehicles (Degirmenci & Breitner, 2017). Moreover, it is expected that this consumer behavior also translates to more positive brand valuations. The personality-perception-adoption framework developed by He et al., (2018) emphasizes that adoption of electrified vehicles has intrinsic antecedents and thus, this motivation is sustained towards brands themselves. Accordingly, the following hypotheses are proposed:

H3: Electrified vehicles will have an impact on consumers' brand valuations.

H3a: Electric vehicles, hybrid electric vehicles and plug-in hybrid electric vehicles will positively influence consumers' brand image, brand trust, brand loyalty and perceived ethicality.

Lastly, the urge to resolve environmental issues has led consumers to rethink their approach to consumerism. As Pelsmacker et al., (2016) underlined, the purchase of an electrified vehicles is seen pro-environmental behavior. This can be connected to Rezvani et al., (2017) who found that positive anticipated emotions are a driver of pro-environmental behavior. Therefore, the following hypotheses are proposed:

H4: Electrified vehicles will have an impact on consumers' purchase intention.

H4a: Electric vehicles, hybrid electric vehicles and plug-in hybrid electric vehicles will positively influence consumers' purchase intention and willingness to pay.

4. Methodology and Data Collection

4.1 Research Method

After thoroughly analyzing the secondary data described in the second chapter of this dissertation, quantitative research was conducted to find answers to the research questions posed in chapter one. Quantitative data was gathered by conducting three experimental studies: a pre-test to identify a well-known automobile brand, a pilot-study to verify that the main study is well understood and does not include errors and lastly, a main study which was used to answer the research questions. All three studies were conducted using an online survey platform called "Qualtrics". This web-based software offers a wide variety of features and tools, such as a customizable survey flow design and question branching techniques, to tailor the survey to the researchers needs, as well as enhance the data collection and interpretation experience.

Making use of the electronic survey methodology ensures that hard-to-involve online users can be reached (Andrews, Nonnecke & Preece, 2003). Additional advantages include the bypassing of time- and cost constraints as the researcher can distribute the survey in a short amount of time to thousands of people regardless of their geographic location. Moreover, online surveys do not require any paper and thus, the researcher can mitigate the costs of print, postage, and data entry (Wright, 2006). On the other hand, there are also several disadvantages when it comes to conducting online surveys. Major weaknesses include the lack of online experience/expertise on the side of respondents, technological variations in terms of internet connection and device of respondents as well as the impersonal nature of online surveys which could limit respondents understanding of the questionnaire and hence bias the results (Evans & Mathur, 2005).

4.2 Sampling

With regards to the sample of this study, a non-probability sampling technique has been applied, namely convenience sampling. This implies that participants have been selected due to their easy accessibility and availability (Taherdoost, 2016). Major advantages of convenience sampling include the efficiency and low costs associated to it, as well as its simple application. However, due to its nature, the sample impairs the generalizability of the data and hence, results of the study must be treated with caution (Jager, Putnik & Bornstein, 2017). The survey was distributed using an anonymous link, created by the web application "Qualtrics", and shared on various social media platforms (LinkedIn, Twitter etc.) and via e-mail.

4.3 Research Instruments

In total, three quantitative studies were developed using the web application "Qualtrics". A pre-test study, a pilot study, and the main study. Below, a detailed description of the design and procedures adopted for each study is shown.

Pre-test study

The pre-test study was designed with the aim to identify a well-known automobile brand among consumers which was later implemented into the main study. Means to verify that the brand is well-known were levels of brand knowledge and hence, brand awareness. This concept refers to Keller's Brand Knowledge Pyramid (2001), more specifically, depth of brand awareness, as an unaided recall technique was proposed in the study.

The short survey consisted of three blocks: #1 a short introduction to familiarize the participants with the purpose of the study, #2 a question that asked participants to indicate their top three brands when thinking about automobile manufacturers and #3 a closing section that thanked the respondents for their time and participation (Appendix 1).

The study was available for participation from the 15th to the 22nd of October 2021 and a total of 81 valid responses were registered. Analysis shows that Mercedes-Benz was stated by 46,9% of all participants as the first brand that came to mind and 22,2% as the second brand that came to mind (Appendix 2). Therefore, Mercedes-Benz was chosen as a well-known automobile brand to be included into the main study of this research.

Pilot study

To test whether the manipulation scenarios, as well as the descriptions of the moderators were understood correctly, a two-step pilot study was established. At first, 20 semi-structured in-depth interviews were conducted in which participants were exposed to the two manipulation scenarios (electrification vs. no electrification), as well as the three different vehicle descriptions (EV, HEV, PHEV). Based on the inputs of those interviews, the manipulation scenarios were re-worked, and the descriptions of the vehicles adjusted. In a second step, a draft of the main study was distributed to 10 participants who were not part of the initial interview sample and who did not participate in the main study. After concluding the pilot study, the 10 respondents were interviewed to verify survey functionalities, wording of the questions, and reliability of the manipulation scenarios.

Main study

The main study was available for participation from the 10th of November until the 27th of November 2021. As elaborated before, the main study was distributed on social media platforms (such as LinkedIn, Twitter, etc.) and via e-mail. To ensure that the minimum number of respondents was met, the study was available in two languages: German and English.

After the first preliminary data preparation such as editing, coding, and cleaning the data, 318 responses were recorded from the initial 376 total responses.

Since the present study followed a 2x3 experimental design, respondents were allocated to one of six possible scenarios. An overview of the total respondents per manipulation scenario can be found in Table 1.

Table 1 - Respondents Allocation to Manipulation Scenarios

		Manipulation Scenario	
		Electrification	**Non-Electrification**
Stimuli	**EV**	52	50
	HEV	48	62
	PHEV	52	54

4.4 Design and Procedure

To answer the research questions of the present study, first, secondary data from previous research on the topic was presented and analyzed. After, primary information was collected with the main study, an online survey created with the web application "Qualtrics", that was available for participation in the month of November 2021 (Appendix 6).

The present study aims to evaluate the impact of well-known automobile brands engagement in electrification on consumers' brand valuations (i.e., brand image, brand trust, brand loyalty & consumer perceived ethicality) and purchase behavior (i.e., purchase intention & willingness to pay), as well as to examine the moderating role of the type of electrified vehicle on named valuation metrics. Thus, the present study followed a 2 (brands' engagement in electrification: yes vs. no) x 3 (type of electrified vehicle: EV, HEV, PHEV) between-within subject's design. Accordingly, participants were allocated to one of six possible scenarios (see Table 2).

Table 2 - Manipulation Scenarios

	Brands' engagement in electrification		**Type of electrified vehicle**		
Scenario	Yes	No	EV	HEV	PHEV
1	x		x		
2	x			x	
3	x				x
4		x	x		
5		x		x	
6		x			x

Ultimately, the main study was composed of five consecutive sections. After participants were welcomed to the survey by means of a short introductory text, they were allocated to one of the six possible scenarios pointed out above.

Beginning with the first section, the German automobile brand *Mercedes-Benz* was introduced. In a series of questions, participants were asked to indicate their level of awareness and familiarity with the named brand.

The following section presented the respondents with either information about the brands' efforts and progress in electrification or neutral information that did not mention electrification at all. Following, respondents were guided through a set of questions measuring the dependent variables of the study: brand image, brand trust, brand loyalty, perceived ethicality, purchase intention and willingness to pay.

The third section of the survey exposed respondents to the moderator of the study, namely the electrified vehicle. According to the manipulation scenarios shown in Table 2, participants were randomly allocated to one of the three vehicles, that is either the EV, HEV or PHEV. Each vehicle was introduced with an interactive description of differentiating key features with regards to other vehicles. After participants declared their understanding of the stimuli, they were asked to imagine a scenario where the brand of choice, *Mercedes-Benz*, would introduce the vehicle shown to its product portfolio. Thereafter, again, respondents were asked to evaluate the brand on the dependent variables of the study.

The fourth section of the study consisted of a single question with 15 items measuring participants environmental consciousness.

Finally, the fifth and last section collected demographic data of the participants (gender, age, occupation, ethnicity, car ownership, driving experience, political orientation, country of residence, educational level, marital status & after-tax household income) and closed the survey with a note, thanking the participants for their contribution as well as indicating that their response was recorded.

4.5 Stimuli Development

To analyze the research questions of the present study, five different stimuli were developed: two for brands' engagement in electrification (vs. not) and three for exposing participants to an electrified vehicle (EV, HEV, & PHEV). The first two stimuli were developed based on the results of the pre-test study. Since *Mercedes-Benz* was chosen as a well-known automobile brand, two different scenarios were created around the brand to fit the needs of the present study: scenario #1 briefed the participants with neutral information about the brand, whereas scenario #2 familiarized respondents with the brands' efforts and engagement in electrification. Both scenarios were created in the form of a short text, where both texts had the same structure: first, the brands' history was elaborated, second, the status quo of the brand was explained, and lastly, an outlook on the future was presented. Additionally, both texts were presented with visual support of two images, one for each scenario, to reinforce the stated information and underline the scenario. Together with the text in scenario #1, an image of three ICEVs, as well as the brand logo of *Mercedes-Benz* were shown. On the other hand, for scenario #2, a picture of the brands newest EV, connected to a wall-box charging the vehicle, was shown. To ensure that participants connect the pictures to the brand, sub-headings were inserted that linked the content of the picture to the brand itself.

Further, for each electrified vehicle, an additional stimulus was created. A technical blueprint of the respective vehicle (EV, HEV, PHEV) was taken as a foundation and adjusted according to the study's needs. Onto the blueprint, five info boxes were inserted, briefly explaining the attributes and characteristics of the respective vehicle, each linked to the according part of the vehicle to facilitate participants understanding of the functionalities. As respondents were exposed to the stimulus while completing the survey, they were asked to click on the info boxes, which then turned green, to indicate their understanding of the stated information. Again, to ensure similarity across the three stimuli, all three followed the same structure and only varied in the product-specific information of the vehicle.

All stimuli developed were empirically tested in a series of 20 semi-structured in-depth interviews that took place from the 19th until the 27th of October 2021. As results were analyzed, the presented stimuli were adjusted accordingly (see Appendix 4 for interview results and Appendix 5 for the stimuli development).

4.6 Variable Description

4.6.1 Manipulation Check

No variable was included into the main study to check if the manipulation worked as intended. However, before launching the pre-test of the main study, 20 semi-structured in-depth interviews were conducted in which participants were exposed to the two different stimuli, as well as the three vehicle descriptions to test if the manipulation was perceived as intended (Appendix 3). Additionally, after distributing the pilot-study, another 10 interviews were carried out to further evaluate whether the stimuli implemented worked as anticipated.

4.6.2 Independent Variable

Automobile brands' engagement in electrification: Participants were exposed to either one of two different manipulation scenarios. One scenario connoted automobile brands' engagement in electrification, whereas the other scenario presented the respondents with neutral information, not mentioning electrification at all.

4.6.3 Dependent Variables

Besides varying assessment of the variable *willingness to pay*, all dependent variables were measured using a 7-point Likert-type scale (1 – strongly disagree; 7 – strongly agree).

Brand Image: Brand image was assessed by extracting 6 items from a scale developed by Hu et. al (2012), three of which measure the perceived level of performance in symbolic values and the other three in functional values ("I perceive *Mercedes-Benz* to be:" "Thoughtful"; "Attractive"; "Confident"; "Human-Oriented"; "Reliable and durable"; "Safe"; "Practical"; "Excellent engine").

Brand Trust: Consumers' trust in brand was measured asking respondents about their level of agreement with the following four statements: "With *Mercedes-Benz*, I obtain what I look for in a car"; "*Mercedes-Benz* is a brand that meets my expectations"; "*Mercedes-Benz* would be honest and sincere in addressing my concerns"; "*Mercedes-Benz* would make any effort to satisfy me", extracted from a brand trust scale established by Munuera-Aleman, Delgado-Ballester & Yague-Guillen (2003).

Brand Loyalty: Assessing consumers' brand loyalty, participants were exposed to three items adapted from Bobâlcă, Gătej (Bradu), & Ciobanu (2012), asking about their level of agreement with the following sentences: "I recommend *Mercedes-Benz* those who ask my advice"; "I say positive things about *Mercedes-Benz* to other persons"; "I consider *Mercedes-Benz* my first choice when I want to buy a new vehicle".

Consumer Perceived Ethicality: To assess consumers' perceived ethicality, respondents were asked to indicate their level of agreement on four items extracted from Brunk (2012): "*Mercedes-Benz* respects moral norms"; "*Mercedes-Benz* is a socially responsible brand"; "*Mercedes-Benz* avoids damaging behavior at all costs"; "*Mercedes-Benz* is a good brand"

Purchase Intention: Consumers' purchase intention was measured by asking respondents about their level of agreement with the following three statements: "I would never buy *Mercedes-Benz*"; "I would seriously consider purchasing *Mercedes-Benz*"; "How likely would you be to purchase *Mercedes-Benz*", adapted from Erdem & Swait (1998, 2004).

Willingness to pay: Willingness to pay was measured by asking respondents if they would be willing to spend more money on automobiles of *Mercedes-Benz*. If participants agreed to this statement, a second question asking participants to indicate how much more money they were willing to spend (in percent) was displayed.

4.6.4 Moderator

Type of electrified vehicle: The moderating effect of the type of electrified vehicle was assessed by exposing the participants to an interactive image of either an EV, HEV, or PHEV. The images contained product specific characteristics and attributes of either one of the above-mentioned vehicles (Appendix 5). After ensuring that respondents familiarized themselves with the image and corresponding information, they were asked to imagine a scenario where *Mercedes-Benz* introduced the presented vehicle to their portfolio. Next, the set of dependent variables about consumers' brand valuations and purchase behavior was posed again.

4.6.5 Covariate

Consumers ecological consciousness: Dunlap & Van Liere (1978) established a measuring instrument called the "New Environmental Paradigm" that served to assess respondents' ecological consciousness in the context of this study. Dunlap, Van Liere, Mertig & Emmet Jones (2000) revised this scale and its 15 items which were included in the present study. Respondents were asked to indicate their level of agreement on a five-point scale (1 – strongly disagree; 5 – strongly agree) to a set of statements about the relationship between humans and the environment: "Humans are severely abusing the environment"; "Plants and animals have as much right as humans to exist"; "…".

4.6.6 Variable Recoding

To facilitate comprehension of the carried-out analysis, the variables presented in Table 3 were recoded. Additionally, one new variable was created representing the six different flow paths a respondent was allocated to.

Table 3 - Variables Recoded

Variable	Re-coded Values
Brands' engagement in electrification	1 = non-Electrification; 2 = Electrification
Type of electrified vehicle	1 = Electric Vehicle; 2 = Hybrid Electric Vehicle; 3 = Plug-in Hybrid Electric Vehicle

5. Analysis and Results

5.1 Sample Characterization

After cleaning the data, a total of 318 valid responses were collected. The following provides an overview of the most important characteristics within the sample collected, whereas a more detailed overview can be found in Appendix 7.

Firstly, the sample is composed by 68,9% male, and 31,1% female respondents.

Concerning respondents age, 54,7% were aged between 19 and 25 years old, followed by 17,9% of all participants aged between 26 and 35 years old and 13,2% aged between 45 and 54 years old. Lastly, 10,1% of the sample were aged between 55 and 64 years old, and the remaining participants were located at the respective ends of the spectrum with 0,6% aged ≤ 18 years old and 1,3% aged ≥ 65 years old.

Further, most respondents currently reside in Germany (71,1%), followed by Portugal (17%) and the United Kingdom (3,1%). Other countries like Bulgaria, Canada, Denmark, Ethiopia, Finland, France, Gabon, Netherlands, Spain, United States of America, and Zimbabwe are included in the statistics with ≤ 2%.

Elaborating on respondents' educational level, 14,5% were holding a diploma or equivalent, 23,3% have completed trade/technical/vocational training, 46,5% were holding a bachelor's degree, 6,3% a master's degree, and 0,6% a doctorate degree. The remaining 6,9% were not holding a diploma and completed some high school, whereas 1,9% preferred not to answer.

Classifying participants occupation, 49,7% were workers, 42,1% students, 2,5% unemployed, 1,3% job seeking, and 4,4% retired.

Lastly, 22% of the respondents stated to have an annual household income after tax of < €15.000, 31,4% mentioned €15.000 - €25.000, 20,1% indicated €25.001 - €35.000, 16,4% marked €35.001 - €50.000 and lastly, 10,1% were located at > €50.000.

Finally, 81,1% of participants mentioned to own a car with a driving experience distribution of 10,1% of up to five years, 54,1% from five to ten years, and 34,6% marking more than ten years of driving experience. Four respondents were not holding a driving license, accumulating to 1,3%.

5.2 Data Screening and Multivariate Outliers

To further increase accuracy of the hereinafter mentioned results, it was aimed at identifying multivariate outliers in the dataset by calculating Mahalanobis distance between the dependent variables of the study. As the distances were inserted into the cumulative distribution function of chi-square, all calculated probabilities were compared to a base value of ≤ .001 (De Maesschalck, Jouan-Rimbraud & Massart, 2000). Results showed that the lowest probability presents a value of .00368 and hence is greater than the base value. Thus, no multivariate outliers were identified, and the author proceeded without further modifying the dataset, leaving 318 valid responses.

5.3 Scales Reliability

To test for reliability, all scales that were composed of three or more items entered a factor analysis. Even though the scales used in this study were extracted from previous literature, proving expressiveness of the applied scales underlines this research's credibility.

Since the dependent variables of this study are measured at five different moments, a factor analysis was conducted for each variable at the five respective moments. The method applied was the principal component analysis where the factors are based on the total variance. Results depicted in Appendix 8 indicated that for all variables at all moments, a factor analysis is useful measured by the KMO and Bartlett's Test with all variables showing values greater than .624, as well as a *p-value* < .05, underlining statistical significance and rejection of the null hypothesis. According to Williams, Onsman & Brown (2010), factor analysis with KMO values close to 1.0 are useful to find underlying factors in the data.

Additionally, to verify internal consistency of the scales measuring the dependent variables of the present study, Cronbach's alpha was computed, following the same procedure as pictured above for the factor analysis. Again, all alphas computed demonstrated coefficient values of .802 and above, implying great internal consistency, as values in the range of .80 and .90 are very good (DeVellis & Thorpe, 2022). No items were deleted in the process of computing the alphas, leaving all scales unmodified with their original number of items (Appendix 8).

Moreover, another principal component analysis was run with the 15 items measuring respondents' ecological consciousness (NEP-Scale). Using varimax rotation, five factors with Eigenvalues above 1.0 were identified. However, the rotated component matrix revealed four factors to be most conclusive with high varying loadings on different items, leading the author to drop the fifth factor (see Appendix 9 for an overview of the items with their respective loadings).

Loadings with values greater than .30 (positive, as well as negative) were considered when defining the new variables extracted from this analysis.

As can be seen in the table, component one facilitated high loadings on items 2, 3, 4, 6, 7, 8, & 12 which underlined the belief of anthropocentrism. Component two presented high loadings on items 5, 8, 9, 10, 11, 13, & 15. Those items correlated to ecological consciousness and awareness of environmental issues. Further, component three was composed by items 3, 6, 7, 10, & 15, which expressed anti-exemptionalism and lastly, component four displayed high loadings on items 1, 8, 10, 12 & 15, underlining fear of crisis. (Dunlap et al., 2000).

Again, verification of internal consistency by computing Cronbach's alpha can be found in Appendix 8. Only component four was modified, since an alpha of .51 led the author to delete items 1 and 12 from the scale, increasing the alpha to .72.

Based on the results, this study will integrate four variables according to the components presented: *Anthropocentrism*, *Ecological Conscious*, *Anti-Exemptionalism*, and *Fear of Crisis*. Table 4 provides an overview of the results, with higher mean scores representing an increased importance of the variable amongst respondents.

Table 4 - Variables Computed Based on Factor Analysis

	Mean	**Std. Deviation**
Anthropocentrism	2.31	.49
Ecological Conscious	4.17	.51
Anti-Exemptionalism	4.29	.61
Fear of Crisis	4.10	.73

5.4 Manipulation Check

To start with, levels of brand awareness and brand familiarity with the chosen brand of the present study, namely *Mercedes-Benz*, were elaborated to verify that it is a well-known automobile brand among respondents. As results of the main study showed (Table 5), brand awareness and brand familiarity were notably high and hence confirmed results of the pre-test. Therefore, the brand of choice is adequate for the present study's purpose.

Table 5 - Descriptive Statistics of Brand Awareness and Brand Familiarity

	Mean	**Std. Deviation**
Brand Awareness	6.23	.82
Brand Familiarity	5.01	1.57

Further, as elaborated in chapter 4.6.1, no variable was implemented into the main study that tested for comprehensiveness of the stimuli. However, a total of 30 semi-structured in-depth interviews led the author to revise the stimuli and test for their effectiveness. Concerning the stimuli for the independent variable of electrification (yes vs. no), minor changes were made to the wording of the respective texts, whereas both visuals remained unaltered. On the other hand, the stimuli used to present the moderator, namely the type of electrified vehicle, was reworked. Instead of presenting respondents with three abstract pictures and information about the respective type of vehicle, technical blueprints of the vehicles were used to further facilitate understanding, as well as text boxes linked to the different parts of the vehicle, that drew a connection between the written information and visual representation (Appendix 5). After the changes were implemented into the main study, results of the pre-test showed that the changes made to the survey were perceived to be positive and increased participants understanding.

5.5 Main Results

5.5.1 The effect of well-known automobile brands' engagement in electrification on consumers' brand valuations and purchase behavior

H1: Well-known automobile brands' engagement in electrification will influence consumers' brand valuations.

H1a: Well-known automobile brands' engagement in electrification will positively affect consumers' brand image, brand trust, brand loyalty and perceived ethicality.

Prior to testing the hypotheses, 14 new variables were computed. The dependent variables of the present study were queried after participants were exposed to the first stimulus, thus representing the control group (neutral scenario), and the manipulation scenario (electrification scenario). After conglomerating the multi-item scales into single variables, H1 was tested by conducting a one-way multivariate analysis of variances (one-way MANOVA) to determine whether there are statistically significant differences between the manipulation means. Even though the test of homogeneity of variances was violated for four of the five dependent variables, robust tests of equality of means (Welch & Brown-Forsythe) indicated that homogeneity of variances was given for this set of variables. Table 6 outlines the findings of the *MANOVA*.

Table 6 - Brands' Engagement in Electrification Main Effect: Brand Valuation

	F test
CPE	20.72***
Brand Image_symbolic	46.53***
Brand Image_functional	7.89***
Brand Trust	23.81***
Brand Loyalty	2.49
Note: ***$p < .001$, **$p < .01$, *$p < .05$, +$p \leq .1$	

Results show a statistically significant main effect of brands' engagement in electrification on: CPE ($F(1,316) = 20.72$, $p<.001$), Brand Image_symbolic ($F(1,316) = 46.53$, $p<.001$), Brand Image_functional ($F(1,316) = 7.89$, $p<.001$), and Brand Trust ($F(1,316) = 23.81$, $p<.001$). No main effect was found for Brand Loyalty ($F(1,316) = 2.49$ $p>.116$). However, results lead to fully accept H1.

Since a main effect was found for four of the five dependent variables, an additional independent samples *t-test* was conducted to further analyze the consequences of brands' engagement in electrification on brand valuations (see Table 7).

Table 7 - Independent Samples T-Test: Brands' Engagement in Electrification: Brand Valuations

	Non-Electrification		**Electrification**		
	M	*SD*	*M*	*SD*	*t-test*
CPE	4.16	1.25	4.74	1.00	-4.60***
Brand Image_symbolic	4.40	1.00	5.21	.81	-6.94***
Brand Image_functional	4.85	1.23	5.2	1.02	-2.83***
Brand Trust	4.24	1.41	4.94	1.08	-4.94***
Brand Loyalty	3.73	1.53	4.00	1.46	-1.58

Note: ***$p < .001$, **$p < .01$, *$p < .05$, +$p \leq .1$

Results of the *t-test*, again, emphasize that there is a statistically significant mean difference in the scores for four of the five dependent variables measuring consumers' brand valuations after exposure to the different manipulation scenarios, namely on: CPE ($M_{Non\text{-}electrification} = 4.16$ vs. $M_{Eelectrification} = 4.74$; $t(311) = -4.60$, $p<.001$), Brand Image_symbolic ($M_{Non\text{-}electrification} = 4.40$ vs. $M_{Eelectrification} = 5.21$; $t(289) = -6.94$, $p<.001$), Brand Image_functional ($M_{Non\text{-}electrification} = 4.85$ vs. $M_{Eelectrification} = 5.2$; $t(312) = -2.83$, $p<.001$), and Brand Trust ($M_{Non\text{-}electrification} = 4.24$ vs. $M_{Eelectrification} = 4.94$; $t(306) = -4.94$, $p<.001$). However, differences in scores for Brand Loyalty ($M_{Non\text{-}electrification} = 3.73$ vs. $M_{Eelectrification} = 4.00$; $t(316) = -1.58$, $+p \leq .1$) are not statistically significant for the present sample.

Ultimately, mean scores are higher for respondents who were exposed to the scenario of electrification in contrast to the mean scores of respondents exposed to the neutral scenario. However, since analysis showed that not all measures of brand valuation increased statistically significant, H1a cannot fully be validated.

H2: Well-known automobile brands' engagement in electrification will influence consumers' purchase behavior.

H2a: Well-known automobile brands' engagement in electrification will positively affect consumers' purchase intention and willingness to pay.

After analyzing the impact on consumers' brand valuations, H2 was tested by running the same analysis for consumers' purchase behavior. Thus, in a first step, a one-way multivariate analysis of variance (one-way MANOVA) was run with purchase intention and willingness to pay as the dependent variables. For purchase intention, homogeneity of variance was rejected, and for willingness to pay, Welch & Brown-Forsythe Tests were statistically significant. Results of the MANOVA are displayed in Table 8.

Table 8 - Brands' Engagement in Electrification Main Effect: Purchase Behavior

	F test
Purchase Intention	4.03**
WTP	2.37
Note: ***$p < .001$, **$p < .01$, *$p < .05$, +$p \leq .1$	

A statistically significant main effect on brands' engagement in electrification on Purchase Intention ($F(1, 316) = 4.03$, $p<.01$) was shown. Further, WTP ($F(1, 112) = 2.37$, $p>.126$) was found to not have a main effect in the analysis and thus, H2 cannot fully be supported.

However, to further elaborate on these findings, another independent samples *t-test* was conducted. Results for the two tested dependent variables are shown in Table 9.

Table 9 - Independent Samples T-Test: Brands' Engagement in Electrification: Purchase Behavior

	Non-Electrification		**Electrification**		
	M	*SD*	*M*	*SD*	*t-test*
Purchase Intention	3.99	1.60	4.88	1.50	-5.09***
WTP	45.66	27.03	38.76	20.86	1.54
Note: ***$p < .001$, **$p < .01$, *$p < .05$, +$p \leq .1$					

The *t-test* underlines Purchase Intention ($M_{Non\text{-}electrification} = 3.99$ vs. $M_{Eelectrification} = 4.88$; $t(315,81) = -5.09$, $p<.001$) to be statistically significant, whereas WTP ($M_{Non\text{-}electrification} = 45.66$ vs. $M_{Eelectrification} = 38.76$; $t(112) = 1.54$, $+p \leq .1$) was not found to be statistically significant. Interestingly, mean scores for WTP decrease with brands' engagement in electrification, whereas scores for Purchase Intention significantly increase. This leads the author to not fully support H2a.

5.5.2 The effect of electrified vehicles on consumers' brand valuations and purchase intentions

H3: Electrified vehicles will have an impact on consumers' brand valuations.

H3a: Electric vehicles, hybrid electric vehicles and plug-in hybrid electric vehicles will positively influence consumers' brand image, brand trust, brand loyalty and perceived ethicality.

To analyze the effect of electrified vehicles on the dependent variables of the present study, seven new variables were computed (see Table 10). Those variables express the mean score differences in the dependent variables before vs. after exposing participants to the electrified vehicle.

Table 10 - Derivation of ΔVariables

Variable	Derivation
ΔCPE	$CPE_{post\text{-}vehicle} - CPE_{pre\text{-}vehicle}$
ΔBrand_Image_symbolic	$BI\_symbolic_{post\text{-}vehicle} - BI\_symbolic_{pre\text{-}vehicle}$
ΔBrand_Image_functional	$BI\_functional_{post\text{-}vehicle} - BI\_functional_{pre\text{-}vehicle}$
ΔBrand_Trust	$BT_{post\text{-}vehicle} - BT_{pre\text{-}vehicle}$
ΔBrand_Loyalty	$BL_{post\text{-}vehicle} - BL_{pre\text{-}vehicle}$
ΔPurchase_Intention	$PI_{post\text{-}vehicle} - PI_{pre\text{-}vehicle}$
ΔWTP	$WTP_{post\text{-}vehicle} - WTP_{pre\text{-}vehicle}$

The new variables measuring consumers' brand valuations entered a one-way multivariate analysis of variance (one-way MANOVA) as dependent variables, with the type of electrified vehicle being the factor (see Table 11).

Table 11 - Type of electrified vehicle Main Effect: Brand Valuation

	F test
ΔCPE	27.13***
ΔBrand_Image_symbolic	23.26***
ΔBrand_Image_functional	16.71***
ΔBrand_Trust	19.69***
ΔBrand_Loyalty	12.02***
Note: ***$p < .001$, **$p < .01$, *$p < .05$, +$p \leq .1$	

Homogeneity of variances was rejected for: ΔCPE, ΔBrand_Image_symbolic, and ΔBrand_Trust. Additionally, Welch & Brown-Forsythe tests for equality of means were statistically significant for ΔBrand_Image_functional and ΔBrand_Loyalty, indicating no

assumptions of the analysis were violated. Results underline a statistically significant main effect of the type of electrified vehicle on all five dependent variables: ΔCPE ($F(2,315) = 27.13$, $p<.001$), ΔBrand_Image_symbolic ($F(2,315) = 23.26$, $p<.001$), ΔBrand_Image_functional ($F(2,315) = 16.71$, $p<.001$), ΔBrand_Trust ($F(2,315) = 19.69$, $p<.001$), and ΔBrand_Loyalty ($F(2,315) = 12.02$, $p<.001$), fully supporting H3.

To further elaborate on the results, post-hoc tests were conducted to identify the specific groups that differed in mean scores of the dependent variables. Post-hoc analyses using the LSD and Bonferroni post-hoc criterion for significance underlined that mean scores for all dependent variables were statistically significantly different between HEVs and the two other electrified vehicles, namely EVs & PHEVs. However, no significant difference in the mean scores between the groups of EVs and PHEVs were found.

Therefore, an additional independent samples *t-test* was conducted, combining the sub-groups of EVs and PHEVs into one group, and comparing them to the group of HEVs (Table 12).

Table 12 - Independent Samples T-Test: Impact of Type of Electrified Vehicle: Brand Valuation

	EV+PHEV		**HEV**		
	M	*SD*	*M*	*SD*	*t-test*
ΔCPE	.69	1.30	-.47	1.42	7.30***
ΔBrand_Image_symbolic	.44	1.18	-.53	1.26	6.82***
ΔBrand_Image_functional	.18	1.25	-.68	1.29	5.78***
ΔBrand_Trust	.35	1.38	-.66	1.39	6.21***
ΔBrand_Loyalty	.56	1.63	-.30	1.15	5.44***

Note: ***$p < .001$, **$p < .01$, *$p < .05$, +$p \leq .1$

T-test results underlined, that there is a statistically significant mean difference in the scores of all dependent variables measuring consumers' brand valuations between the aggregated group of EVs & PHEVs, compared to the group of HEVs: ΔCPE ($M_{EV+PHEV} = .69$ vs. $M_{HEV} = -.47$; $t(316) = 7.30$, $p<.001$), ΔBrand_Image_symbolic ($M_{EV+PHEV} = .44$ vs. $M_{HEV} = -.53$; $t(316) = 6.82$, $p<.001$), ΔBrand_Image_functional ($M_{EV+PHEV} = .18$ vs. $M_{HEV} = -.68$; $t(316) = 5.78$, $p<.001$), ΔBrand_Trust ($M_{EV+PHEV} = .35$ vs. $M_{HEV} = -.66$; $t(316) = 6.21$, $p<.001$), and ΔBrand_Loyalty ($M_{EV+PHEV} = .56$ vs. $M_{HEV} = -.30$; $t(290{,}59) = 5.44$, $p<.001$). Scores of the dependent variables increased after participants were exposed to EVs and PHEVs. However,

exposure to HEV significantly decreased mean scores of the dependent variables, leading to partially accepting H3a.

H4: Electrified vehicles will have an impact on consumers' purchase intention.

H4a: Electric vehicles, hybrid electric vehicles and plug-in hybrid electric vehicles will positively influence consumers' purchase intention and willingness to pay.

Further, after evaluating the impact of electrified vehicles on consumers' brand valuations, similar statistical tests were run to examine the impact on consumers' purchase behavior. Thus, another one-way MANOVA was conducted (see Table 13)

Table 13 - Type of Electrified Vehicle Main Effect: Purchase Behavior

	F test
ΔPurchase_Intention	0.59
ΔWTP	6.25***
Note: ***$p < .001$, **$p < .01$, *$p < .05$, +$p \leq .1$	

To begin with, homogeneity of variances was rejected for ΔPurchase_Intention, but not for ΔWTP. Hence, Welch & Brown-Forsythe tests of equality of means showed that no violation of the analysis was present since the test was statistically significant for the latter variable with a *p-value* <.05. Results indicated a statistically significant main effect of the type of electrified vehicle on ΔWTP ($F(2,59) = 6.25$, $p<.001$), but not on ΔPurchase_Intention $F(2,315) = 50.59$, $p \geq .1$, leading the author to partially accept H4.

To gain a deeper understanding of the main effect, the results of post-hoc tests were analyzed for the variable measuring willingness to pay. As expected, similar results as seen for consumers' brand valuation were found. Using the LSD and Bonferroni post-hoc criterion, two groups can be identified: EVs and PHEVs showed statistically significant differences to HEVs, whereas EVs and PHEVs were not statistically significant different among each other. Now, since ΔWTP was found to have a main effect on the type of electrified vehicle and post-hoc tests identified two main groups, another independent samples *t-test* was conducted (Table 14).

Table 14 - Independent Samples T-Test: Impact of Type of Electrified Vehicle: Purchase Behavior

	EV+PHEV		**HEV**		
	M	*SD*	*M*	*SD*	*t-test*
ΔWTP	-4.45	16.24	9.67	16.86	-3.07***

Note: ***$p < .001$, **$p < .01$, *$p < .05$, +$p \leq .1$

Again, results underline that there is a statistically significant mean difference in the scores of the dependent variable: ΔWTP ($M_{EV+PHEV}$ = -4,45 vs. M_{HEV} = 9,67; $t(60)$ = -3,07, p<.001). Willingness to pay increases for the dependent variable concerning HEVs, whereas it decreases for the other two types of electrified vehicles, namely EVs and PHEVs. Thus, H4a cannot be fully accepted.

To conclude the main results, Table 15 provides an overview of the established hypotheses and indicates whether they were rejected or accepted by the statistical analysis.

Table 15 - Results of Hypotheses Testing

Hypotheses	**Results of Statistical Analysis**
H1	Fully confirmed
H1a	Partly confirmed
H2	Partly confirmed
H2a	Partly confirmed
H3	Fully confirmed
H3a	Partly confirmed
H4	Partly confirmed
H4a	Partly confirmed

5.6 Further Analysis

5.6.1 The impact of consumer ecological consciousness as a covariate on brands' engagement in electrification and type of electrified vehicle

First, a 2 (brands' engagement in electrification) x 3 (type of electrified vehicle) two-way multivariate analysis of variances was run. The dependent variables of the study were included measured in three different moments: after the first stimulus was presented; after the second stimulus was presented; and lastly, the mean score differences in the variables as pictured in Table 10. Additionally, to increase accuracy of results, the dependent variable measuring willingness to pay was excluded, since the sample size would drastically decrease as this variable was only assessed for participants indicating a disposition to pay more money for the respective vehicle in each scenario.

As the two-way MANOVA analysis results reflected the previous findings, no interaction effect of the brands' engagement in electrification and the type of electrified vehicle on any of the dependent variables was found (Appendix 10).

Additionally, to evaluate the impact of consumers' ecological consciousness on the dependent variables, another two-way MANCOVA was conducted, including the four variables extracted from the NEP-scale (Table 4) as covariates (see Appendix 11).

Contrasting the results of the two-way MANOVA with the results of the two-way MANCOVA, it can be stated that, even though scores are affected by the covariates, there are no statistically significant changes to report. Hence, the four NEP-scale variables are not considered to be covariates of the model.

5.6.2 Demographic factors influencing consumers' purchase behavior of electrified vehicles

To find demographic factors influencing consumers' purchase behavior of electrified vehicles, eight new dummy variables based on the demographic variables evaluated in the main study were created (see Table 16). However, DCountry_Residence was not found to have a statistically significant effect on the established models and thus was not considered in further analysis.

Table 16 - Dummy Variables

	Categories (n-1)	*Base Value*
DGender	1	"Female"
DAge	6	"0-18 years old"
DCountry_Residence	-	-
DCar_Ownership	1	"No car"
DDriving_Experience	2	"Up to five years"
DPolitical_Orientation	6	"Far left"
DEducation	6	"No schooling completed"
DIncome	4	"<€15.000"

First, a *linear regression model* was run with the dependent variable being purchase intention (measured post exposure of the second stimulus) and the re-coded variables from Table 16 as the independent variables. As the author chose to use the "stepwise" method due to the high number of predictor variables Table 17 provides the results of the according ANOVA.

Table 17 - ANOVA Table of Linear Regression

	Df	*Sum Sq*	*Mean Sq*	*F-test*	*Pr(>F)*
Regression	2	111.46	55.73	30.27	.000
Residual	315	579.92	1.84		

Results of the ANOVA underlined that the regression model was statistically significant [$F(2, 315)=30.27$, $p<.05$], leading the author to proceed with the analysis. Hence, the obtained findings of the model are shown in greater detail in Table 18.

Table 18 - Multiple Linear Regression Analysis Results Related to Overall Purchase Intention of Electrified Vehicles

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Variables	*B*	SH_B	β	*T*	*p*	*Tolerance*	*VIF*
Constant	4.41	.31	-	14.25	.00	-	-
DAge	-.39	.05	-.40	-7.57	.00	.97	1.03
DPolitical_Orient	.32	.11	.16	2.98	.00	.97	1.03
Note: R=0.402; R^2=0.161							

Examining the results presented in Table 18, two of the seven independent variables in the standard model are statistically significant to predict changes in the dependent variable. The model explained 16,1% of the variance in purchase intention of electrified vehicles, whereas DAge was found to have the greatest impact on the dependent variable ($\beta_1 = -.39, p<.001$). Finally, the model can be summarized as following:

*Purchase intention of electrified vehicles = 4.41 + .32*DPolitical_Orientation – .39*DAge*

As the previous regression model was found to be significant and the variance in the dependent variable was explained by the demographic predictor variables, a further analysis was conducted to explain purchase intention for each of the electrified vehicles separately. Therefore, the data was split by *type of electrified vehicle* (Table 3) and three more linear regression models were established.

Purchase intention was taken as the dependent variable and the dummy variables (Table 16) entered the model as independent variables, with cases sorted by the type of electrified vehicle. Regarding electric vehicles (EVs), Table 19 depicts the results of the ANOVA.

Table 19 - ANOVA Table for Linear Regression: Electric Vehicles

	Df	*Sum Sq*	*Mean Sq*	*F-test*	*Pr(>F)*
Regression	1	8.54	8.54	4.84	.030
Residual	100	176.43	1.76		

Results of the ANOVA underlined statistical significance of the model [$F(1, 100)=4.48, p<.05$], which led the author to proceed with the analysis.

As the predictor variables entered the model one at a time, results shown in Table 20 present only one independent variable, namely DDriving_Experience.

Table 20 - Linear Regression Analysis Results Related to Purchase Intention of EVs

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Variables	*B*	SH_B	β	*T*	*p*	*Tolerance*	*VIF*
Constant	5.47	.33	-	16.61	.00	-	-
DDriving_Exp	-.56	.26	-.22	-2.2	.03	1.00	1.00
Note: R=0.215; R^2=0.046							

DDriving_Experience entered the model, emphasizing a statistical significance in predicting the change in the dependent variable (β_1 = *-.56, p<.05)*. Overall explanatory power of the regression model accumulated to 4,6% in changes of purchase intention for EVs, solely explained by DDriving_Experience. The regression equation was extracted as following:

*Purchase intention of EVs = 5.47 + (-.56*DDriving_Experience)*

Next, a similar regression model was extracted to explain the changes in purchase intention for HEVs. Table 21 outlines the results of the ANOVA obtained by running the regression analysis.

Table 21 - ANOVA Table for Linear Regression: Hybrid Electric Vehicles

	Df	*Sum Sq*	*Mean Sq*	*F-test*	*Pr(>F)*
Regression	2	12.99	6.50	5.11	.008
Residual	107	135.92	1.27		

The model was found to be statistically significant [$F(2, 107)=5.11$, $p<.01$]. Hence, the author proceeded with the analysis.

The coefficient matrix provided in Table 22 shows that DAge, as well as DPolitical_Orientation entered the model as predictor variables for purchase intention for HEVs.

Table 22 - Linear Regression Analysis Results Related to Purchase Intention of HEVs

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Variables	*B*	SH_B	β	*T*	*p*	*Tolerance*	*VIF*
Constant	3.49	.41	-	8.5	.00	-	-
DAge	-.23	.08	-.30	-3.01	.00	.87	1.15
DPolitical_Orient	.32	.16	.21	2.09	.04	.87	1.15
Note: R=0.295; R^2=0.087							

The strongest predictor of the change in the dependent variable is DPolitical_Orientation (β_1 = *.32, p<.05)*, followed by DAge (β_2 = *-.23, p<.01)*. The overall explanatory power of the regression model was found to be 8,7% in change of purchase intention by the two independent variables. The regression equation obtained can be displayed as shown below:

*Purchase intention of HEVs = 3.49 + .32*DPolitical_Orientation – .23*DAge*

Lastly, a third regression model was obtained predicting the purchase intention for PHEVs with the dependent variables inserted as shown in Table 16. Again, the ANOVA was found to be statistically significant (see Table 23).

Table 23 - ANOVA Table for Linear Regression: Plug-in Hybrid Electric Vehicles

	Df	*Sum Sq*	*Mean Sq*	*F-test*	*Pr(>F)*
Regression	2	131.33	65.67	40.32	.000
Residual	103	167.75	1.63		

Proceeding with the analysis due to the results of the ANOVA [$F(2, 103)=40.32$, $p<.001$], another coefficients matrix was extracted using the stepwise method in linear regression. Table 24 shows that two of the seven predictor variables entered the model, explaining 43,9% of the total variance in the dependent variable, namely purchase intention of PHEVs.

Table 24 - Linear Regression Analysis Results Related to Purchase Intention of PHEVs

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Variables	*B*	SH_B	β	*T*	*p*	*Tolerance*	*VIF*
Constant	7.17	.36	-	19.76	.00	-	-
DAge	-.69	.08	-.64	-8.68	.00	.99	1.01
DCar_Ownership	-1.01	.33	-.23	-3.06	.00	.99	1.01
Note: R=0.663; R^2=0.439							

The change in purchase intention of PHEVs is strongest explained by DCar_Ownership (β_1 = *-1.01, p<.001)*, followed by DAge (β_2 = *-.69, p<.001)*. Overall, the equation that was extracted from the multiple regression analysis can be concluded as following:

*Purchase intention of PHEVs = 7.17 + (-1.01*DCar_Ownership) – .69*DAge*

6. Conclusions and Implications

The present study's main purpose was to evaluate whether consumers' brand valuations and purchase behavior are affected by automobile brands engagement in electrification, as well as to examine whether the type of electrified vehicle moderates this relationship.

As pictured for the first research question (RQ1), results emphasize that for well-known automobile brands' engaging in electrification, consumers' brand valuations and purchase behavior increase, except for measurements of brand loyalty. These findings can be derived from previous research on electrified vehicles (Conway et. al, 2012; Browne & Allen, 2011; Figliozzi, 2010; Degirmenci & Breitner, 2017; He et al., 2018), and underline that electrified vehicles are seen as more sustainable alternatives to ICEVs and that this has a direct effect on the respective automobile brand. The non-significant increase in brand loyalty can potentially be explained by Tucker's (1964) concept of consumers' biased choice behavior. Participants of the present study were not given the opportunity to evaluate on different brands, but only on one single brand. As respondents could not chose their preferred brand, measuring brand loyalty proved to be difficult, which also reflects the main findings.

Findings extracted concerning the second research question (RQ2) show, that the introduction of any electrified vehicle does moderate the relationship between automobile brands' engagement in electrification (vs. not) and consumers' brand valuations and purchase behavior of those brands. However, as the present study differed between three types of electrified vehicles, results underline that EVs and PHEVs positively affect brand valuations, whereas exposure to HEVs yield a decrease in brand valuations. Consequently, the three electrified vehicles can be split into two groups, based on their moderating effect on the relationship between brands' engagement in electrification and consumers' brand valuations and purchase behavior: #1 EVs & PHEVs; #2 HEVs. Group #1 underlines a positive moderating effect, whereas group #2 depicts a negative moderating effect. This finding supports prior research by Singh, Bansal, & Singh (2019), as EVs and PHEVs offer more advantages than HEVs in terms of driving range, efficiency, and overall cost.

Further, results of the additional analysis emphasize that there is no interaction effect of automobile brands engaging in electrification (vs. not) and the type of electrified vehicle they introduce. This shows that either the brand, or the electrified vehicle independently affect consumers' brand valuation and purchase behavior, concluding that perceived quality and prior knowledge of the brand itself are major determinants of valuation metrics (Baltas & Saridakis, 2010). To add, results also indicate that consumers own ecological consciousness does not

influence their respective valuations of the brand. This finding potentially underlines that highly environmentally conscious consumers are yet indifferent about the impact of electrification on the environment (Woo et al., 2017).

Next, results of the additional analysis suggest that purchase intention towards electrified vehicles can be predicted by socio-demographic factors. As prior literature states no explanatory power of those factors on purchase intention (Sierzchula et al., 2014), analysis shows that political orientation and gender can be predictors of purchase intention of electrified vehicles. In detail, more left-wing and liberal oriented consumers, especially males, are more likely to buy electrified vehicles. Additionally, as the regression models show, purchase intention for EVs and HEVs are influenced by an increase in participants driving experience and decrease in participants' age.

Concluding, this study provides insights into the positive effect of automobile brands' engagement in electrification and the introduction of electrified vehicles with respective differentiation among the three different types of vehicles. This holds true even for brands who are not actively promoting their efforts in vehicle electrification and should be considered for further brand strategies, as discussed in the following sections.

6.1 Theoretical Implications

The present study contributes to the existing literature on electrification (Emadi & Petrunić, 2014; Rangaraju, De Vroey, Messagie, Mertens & Van Mierlo, 2015; Woo et al., 2017), more specifically, on the impact of automobile brands engaging in electrification on consumers' brand valuations and purchase behavior (Browne & Allen, 2011; Conway et. al 2012; Figliozzi, 2010). Given the fact that electrification does not necessarily imply sustainability and environmental awareness (Woo et al., 2017; Rangaraju et al., 2015; Juan & Mendez, 2016), this research adds to existing literature that the type of electrified vehicle moderates the relationship between brands' engagement in electrification and consumers' brand valuations and purchase behavior.

Moreover, previous literature on CPE (Brunk, 2010), and its direct effect on perception of brands (Singh et al., 2012) are confirmed by this research, as conclusions resulted in an equally strong increase in the named variables of CPE and other measures of brand valuation.

Additionally, this study adds to existing literature on consumers' purchase behavior of green products (Pelsmacker et al., 2016; Rezvani et al., 2017, 2018) as findings neglected the impact of consumers' ecological consciousness on the purchase of high-involvement products, namely electrified vehicles.

Finally, conclusions obtained from the regression analyses partly contradicted Sierzchula et al.'s (2014) research, as their findings stated that socio-demographic factors are not good predictors of purchase intention for EVs, which was different for the present study, especially for PHEVs. Indeed, socio-demographic variables have explanatory power over purchase intention of electrified vehicles and thus, this finding adds valuable information to existing literature on adoption of electrified vehicles (Degirmenci & Breitner, 2017; He et al., 2018).

6.2 Managerial Implications

As the topic of electrification gains more traction in the automobile industry, the present study provides useful and relevant implications for businesses in their transformation process.

Findings underline that consumer positively evaluate well-known automobile brands that actively engage in electrification. Consequently, those brands are not only regarded as more ethical and environmentally friendly, but also consumers purchase behavior towards them increases positively. Thus, far-reaching consequences can be drawn based upon the measured impacts of this study.

Interestingly, even though electrification in the automobile industry is a double-edged sword with the GHG intensive production process of electrified vehicles, as well as the pollutant process of generating energy by non-renewable sources, brands are not affected by the aforementioned factors, implying that they should foster on this finding and further proceed investing into electrification.

Moreover, results indicated that the three types of electrified vehicles can be divided into two groups: group #1 consisting of EVs and PHEVs and group #2 consisting of HEVs. Brand valuations and purchase intention proof to be similar within group one but different between the two groups. Since the strongest, most positive impact is achieved by vehicles of group one, this study suggests focusing on EVs and PHEVs as the main drivers of brands' electrification. This contributes to existing literature by Spurlock et. al (2019), since their study was not able to differentiate between PHEVs and HEVs as participants were not able to clearly differentiate the features of the respective vehicles.

Additional insights suggest that there is no interaction effect between brands' engagement in electrification and the type of electrified vehicle. This underlines that automobile brands that are not invested into electrification but want to enter the market, can do so without experiencing negative drawbacks from the side of consumers. As previously mentioned, entering markets with group one vehicles can further increase likelihood of positive brand valuations and an increase in purchase intention.

Lastly, results of the extra analysis on demographic variables explaining purchase intention of electrified vehicles yield great implications on how automobile brands' can adapt their communication design and market segmentation. Per regression models, a target group for each vehicle can be derived and touchpoints of this group with the brands can be extracted, allowing them to narrowly focus their marketing efforts based on customers standpoint in their respective customer journey. This implies great opportunities for automobile brands as adoption of electrified vehicles is still on the rise and pin-pointing the focus of marketing efforts may increase adoption and respective sales of the vehicles.

7. Limitations and Future Research

The most impactful limitation arises with the use of an online survey as the main research instrument of this study. Even though the study was tested prior to launching it, a single participant not fully understanding the question can potentially bias the results (Coutts & Jann, 2009). As there are many common survey biases known to exist, it is impossible to mitigate all their potential effects on the results (Hufnagel & Conca, 1994).

Further, the sample of the main study consisted mainly of German residents (71,1%), presenting itself to be geographically limited. Therefore, lack of cultural differences in responses affect the outcomes of the analysis.

Additionally, the sample size of the main study was rather small, as 318 valid responses were collected. A greater sample size could have yielded greater accuracy in results and thus must be considered when interpreting the data.

Moreover, parts of the online study were perceived to be complex, as shown in the interview notes (Appendix 4). Vehicle descriptions of the three stimuli may have been too complex for respondents, resulting in boredom and decrease of attention, and ultimately, adulteration of results.

Consequently, further research is suggested to be undertaken with the aim of verifying the results in other geographical regions. Furthermore, emphasis must be put on collecting data from greater samples, underlining the credibility of the respective analysis.

Also, existing literature mainly focuses on EVs, instead of all types of electrified vehicles, as those vehicles are regarded as the future of e-mobility. Therefore, the derivation of the hypotheses was extracted from literature on EVs, rather than literature on each individual electrified vehicle. Time and resource constraints limited the literature review to focus on EVs and to generalize the findings on the other two types of vehicles.

Lastly, this study focused on electrification of well-known automobile brands, more specifically, well-known premium automobile brands. Future research on the impact of electrification of non-premium or low-cost brands can yield greater insights into the impingements of electrification on automobile brands in general.

8. Appendices

Appendix 1: Pre-Test Study

Introduction

Dear Participant,

Thank you for taking a short minute to answer this survey.
The following has been deigned in the course of my master's dissertation at Católica Lisbon SBE.

As mentioned before, completing the survey will take you less than one minute.
Your answers will be treated anonymously and with complete confidentiality.

Thank you for your participation.
Patrick Schiffers

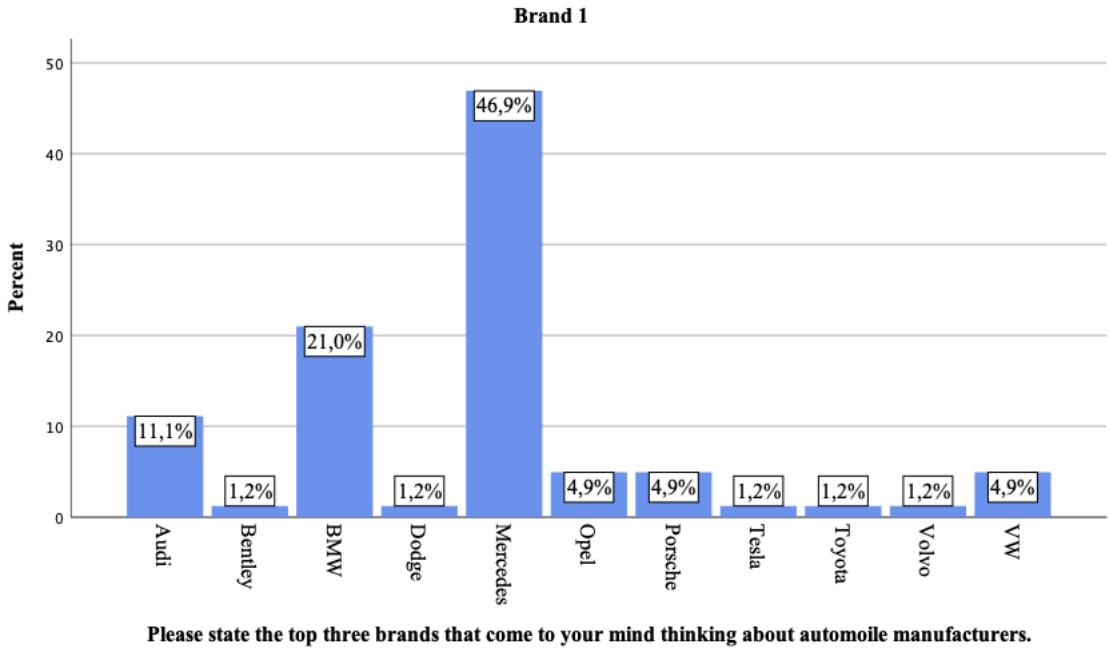
Q1: Please state the top three brands that come to your mind when thinking about **automobile manufacturers**. If you do not know any brands, please type "X" in the boxes below.

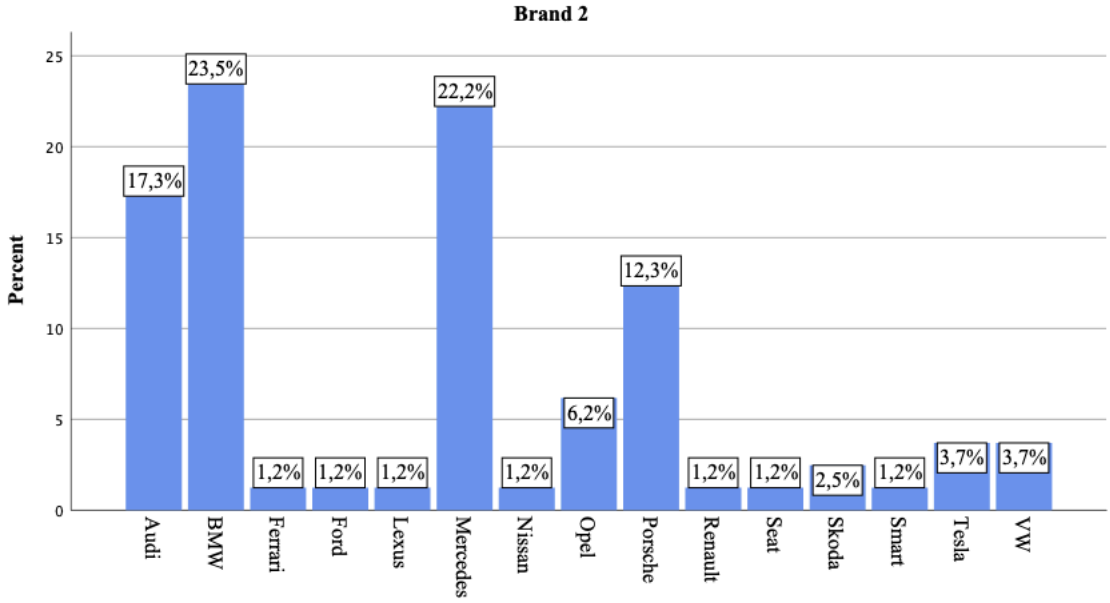
Brand 1	
Brand 2	
Brand 3	

End of Survey

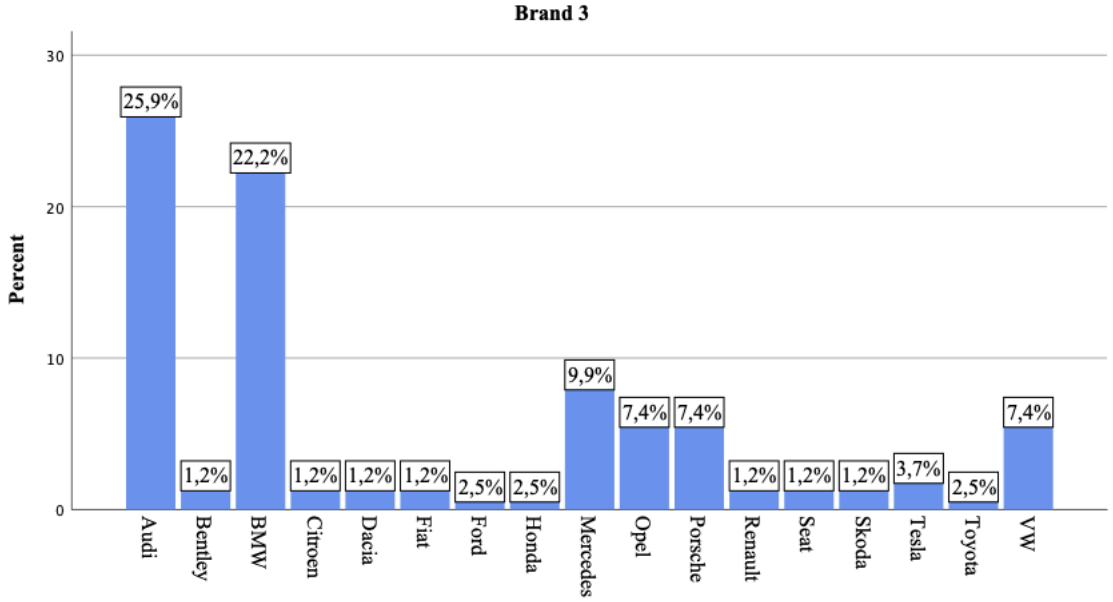
Thank you for your time spent taking this survey.
Your response has been recorded.

Appendix 2: Pre-Test Study Results





Please state the top three brands that come to your mind thinking about automoile manufacturers.



Please state the top three brands that come to your mind thinking about automoile manufacturers.

Appendix 3: Interview Guidelines

Introduction

Thank you for participating in this interview today.

My name is Patrick, I am a masters' student at Católica SBE, currently writing my dissertation on the topic of automobile electrification and this interview serves the purpose of understanding what consumers know and how they feel about it. Further, it will serve as a foundation to the main study conducted in my thesis.

This interview should take about 30 minutes.

Feel free to ask any questions during the interview.
For organizational reasons, I will be recording this session.

All information gathered will be treated with strict confidentiality and is solely used for research purposes. You can refuse to answer and end the interview at any point. Remember, there are no right or wrong answers.

Do you have any questions about the previous introduction? Do you agree to participate in this interview?

Filter Questions

How old are you?
What gender do you identify with?
Where do you currently reside?
What is your nationality?

Opening

When was the first time you heard about electrification? What do you know about it?
- *Which automobile brand do you connect to this term?*
- *Do you already have experience with this topic?*
    - *If yes, was it a good/pleasant experience? Please elaborate.*

Central Part

Have you ever heard or seen about Mercedes-Benz?
- *What do you connect to this brand?*
- *What comes to your mind thinking about the brand?*

Can you name any specific car models that come to your mind when thinking about the brand?
- *What were the reasons for you thinking about these models in specific?*
- *Have you heard good/bad things about the brand and its models?*

Now, interviewees were exposed to both manipulation scenarios (electrification & neutral). Prior to being exposed to the picture and corresponding text, the following questions were posed:

What is the first thing that comes to your mind when reading/seeing this?
- *What does this tell you about Mercedes-Benz?*
- *Does this change your perception of the brand? To what extend and why?*
- *How do you feel after seeing/reading this?*
- *What do you think is the core message of this information?*
- *Does this scenario make you think of electrification?*

After exposure to both manipulation scenarios, participants were asked the following:

Which one of the scenarios do you consider to be more future-oriented and sustainable?

Thereafter, interviewees were invited to answer questions regarding electrified vehicles. Further, the initial stimuli for the three types of electrified vehicles used in this study were presented. Based on those stimuli, participants were asked about their understanding and comprehension of the present stimuli. (A detailed overview of the initial stimuli and progress made after conducting the interviews can be found in Appendix 5).

After looking at the three pictures in depth, please answer the following questions:
- *Is this information for you sufficient to understand what an EV/HEV/PHEV is?*
- *Would you like to have additional information other than a functional description?*
    - *E.g., average emissions, driving range, etc.?*
- *Would you like to see a comparison amongst these electrified vehicles?*
- *Are the symbols clear and easy to understand?*
    - *Do they help you with the understanding of the topic?*

Closing

Do you have anything to add or further questions?

Thank you for your time and participation

Appendix 4: In-depth Interview Results

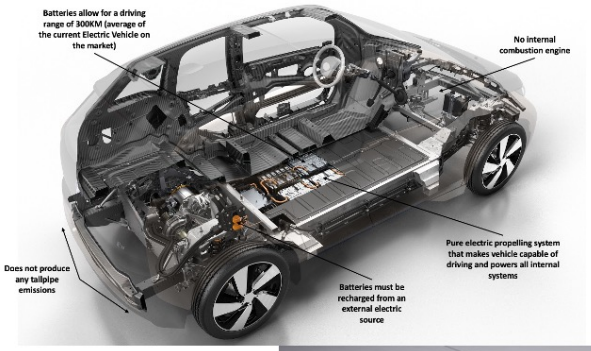
			20 In-depth Interviews **Main Findings**
Opening	**State of Knowledge**	*Q1*	On average, 4-5 years ago; topic is already present in the mind of consumers
		Q2	Tesla clearly top-of-mind brand; BMW and Mercedes-Benz follow on 2nd and 3rd place
		Q3	Sample was slightly knowledgeable; some did work in the industry, and some had no experience at all
Central Part	**Familiarity and Awareness**	*Q4*	All participants heard of Mercedes-Benz and were familiar with the products
		Q5	Most named keywords were: premium, elegance, & prestigious
		Q6	Associations most stated: high quality vehicles, AMG (which is a sub-brand of Mercedes-Benz, building high performance cars), & timeless design
	Brand Perception & Car Models	*Q7*	Participants were familiar with the most common car models, not specifically mentioning the brands' electrified vehicles
		Q8	High brand awareness due to strong vehicle presence on the roads; personal preference and interest in cars also moderate the perception
		Q9	Very mixed opinions, some respondents perceive the Mercedes-Benz to be over-priced and too involved into environmental scandals, other respondents underline durability and reliability of the vehicles
	Scenario 1	*Q10*	Big and successful company with an impressive track record; long history which increases perception of quality
		Q11	Successful company with loyal customers and long, proud history
		Q12	Overall, perception of the brand did not change
		Q13	Respondents reacted unphased after exposure
		Q14	Three keywords stood out: long history, successful, & prestigious
		Q15	"No" from all respondents

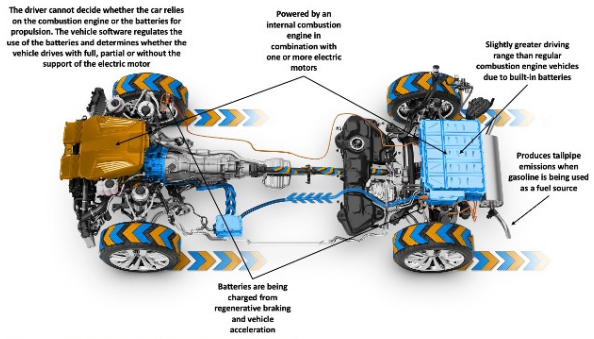
Central Part	**Scenario 2**	*Q16*	Mostly “electrification” was stated; change and innovation were named as well; progress in e-mobility was mentioned
		Q17	Connection to innovation and sustainability was established; Mercedes-Benz was called future-oriented and on the verge of transformation
		Q18	Most respondents did not know about the brands’ efforts in e-mobility; impressed by the efforts
		Q19	Generally, mixed feelings were expressed; some mentioned that it makes the brand competitive in the long-term, others are questioning the electricity that must be generated to run those vehicles
		Q20	Mainly the change to e-mobility was emphasized; Mercedes-Benz wants to tackle current challenges
		Q21	“Yes” from all respondents
	Future-oriented & Sustainable	*Q22*	All participants agreed that Scenario 2 was the one more future-oriented and sustainable, remind them of electrification
	General EV knowledge	*Q23*	Some respondents had experience with electrified vehicles, which were mainly positive; others did not have any experience and were mainly skeptical about them
		Q24	Most importantly, driving range was mentioned; additionally, charging infrastructure, affordability and long-battery life were stated
		Q25	Broad knowledge of the vehicles, some heard of the abbreviations but did not have specific knowledge about them
	Feedback on Stimuli	*Q26*	Participants agreed that the information was sufficient to get a basic understanding, but the presentation was poor
		Q27	Additional information about emissions produced and range were preferred
		Q28	Mixed opinions: mainly, comparison would be nice, but is by no means necessary
		Q29	The presentation should be improved to enhance understanding of the presented vehicles; PHEV and HEV were not really clear in their comparisons
		Q30	Mainly yes, but only after seeing the information with the symbols
Closing	**End of Interview**	/	*No further questions or annotations were made in the closing section of the interview. Interviewees were thanked for their participation.*

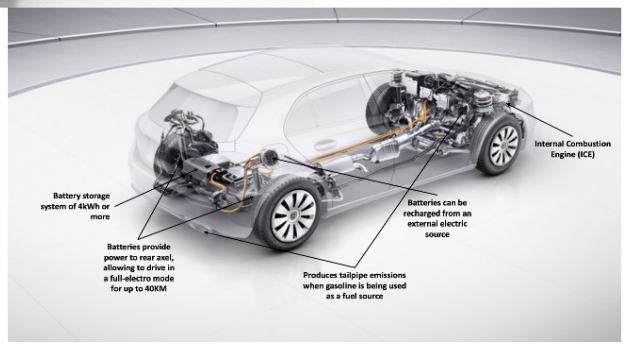
Appendix 5: Stimuli Development and Rework

Type of Vehicle

Rework	EV	HEV	PHEV
Main body	Blueprint of an EV instead of two symbols reminding of EVs No plain/technical information that is boring to process Enhanced visual appearance	Blueprint of an HEV instead of two symbols reminding of HEVs No plain/technical information that is boring to process Enhanced visual appearance	Blueprint of an PHEV instead of two symbols reminding of PHEVs No plain/technical information that is boring to process Enhanced visual appearance
Details	Connecting information by highlighting component of vehicle with technical information	Connecting information by highlighting component of vehicle with technical information	Connecting information by highlighting component of vehicle with technical information
Additional information	Tailpipe emissions Driving range No ICE Location of components in vehicle	Tailpipe emissions Driving range Location of components in vehicle	Tailpipe emissions Location of components in vehicle







Appendix 6: Main Study

Introduction

Dear Participant,

Thank you for taking the time to complete this survey.

This questionnaire is conducted as part of my master's dissertation at Católica Lisbon SBE and intends to study consumers' brand perceptions within the automobile industry.

The survey will approximately take 10 minutes to complete.

Your participation is voluntary and there are no right or wrong answers.
Please be assured that all information given will remain anonymous and confidential.

If any doubts arise throughout your process of completing this questionnaire, please do not hesitate to contact me: s-pschiffers@ucp.pt.

Thank you,
Patrick

Brand Familiarity and Brand Awareness
Please consider everything you have heard, seen, or experienced about the German automobile brand **Mercedes-Benz**.

Q1: On a scale from 1 (strongly disagree) to 7 (strongly agree), please rate your level of agreement with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I have seen or heard about Mercedes-Benz	○	○	○	○	○	○	○
I am aware of the products that Mercedes-Benz offers	○	○	○	○	○	○	○

Q2: Regarding Mercedes-Benz, are you:

Unfamiliar	○ ○ ○ ○ ○ ○ ○	Familiar
Inexperienced	○ ○ ○ ○ ○ ○ ○	Experienced
Not knowledgeable	○ ○ ○ ○ ○ ○ ○	Knowledgeable

Q3: Considering past touchpoints and experiences with the named brand, what is your general attitude towards Mercedes-Benz?

Very negative	○ ○ ○ ○ ○ ○ ○	Very positive

Block 1 – No Electrification / Neutral Scenario

Mercedes-Benz is a German automotive brand operating under the umbrella of Daimler AG. The brand's history goes back to 1882 when Gottlieb Daimler and Wilhelm Maybach worked together to design the first-ever single-cylinder engine. Technological advancements over the following decades resulted in more powerful and more durable combustion engines that are installed in the brand's vehicles up to this day.

Nowadays, Mercedes-Benz AG is one of the largest manufacturers of luxury passenger cars with more than 2.1 million vehicles sold in 2020. To meet the increasing demand for vehicles, the company is continually expanding its worldwide production network, operating 35 production sites on four continents.

Mercedes-Benz products

After reading the text about Mercedes-Benz, please answer the following questions:

Q4: On a scale from 1 (strongly disagree) to 7 (strongly agree), please rate your level of agreement with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Mercedes-Benz respects moral norms	○	○	○	○	○	○	○
Mercedes-Benz is a socially responsible brand	○	○	○	○	○	○	○
Mercedes-Benz avoids damaging behavior at all costs	○	○	○	○	○	○	○
Mercedes-Benz is a good brand	○	○	○	○	○	○	○

Q5: I perceive Mercedes-Benz to be:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Thoughtful	○	○	○	○	○	○	○
Attractive	○	○	○	○	○	○	○
Confident	○	○	○	○	○	○	○
Human-oriented	○	○	○	○	○	○	○
Reliable and durable	○	○	○	○	○	○	○
Safe	○	○	○	○	○	○	○
Practical	○	○	○	○	○	○	○

Excellent engine	○	○	○	○	○	○	○

Q6: On a scale from 1 (strongly disagree) to 7 (strongly agree), please rate your level of agreement with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
With Mercedes-Benz, I obtain what I look for in an automobile	○	○	○	○	○	○	○
Mercedes-Benz is a brand that meets my expectations	○	○	○	○	○	○	○
Mercedes-Benz would be honest and sincere in addressing my concerns	○	○	○	○	○	○	○
Mercedes-Benz would make any effort to satisfy me	○	○	○	○	○	○	○

Q7: On a scale from 1 (strongly disagree) to 7 (strongly agree), please rate your level of agreement with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I recommend Mercedes-Benz those who ask my advice	○	○	○	○	○	○	○

I say positive things about Mercedes-Benz to other persons	○	○	○	○	○	○	○
I consider this brand my first choice when I want to buy a new automobile	○	○	○	○	○	○	○

Q8: On a scale from 1 (strongly disagree) to 7 (strongly agree), please rate your level of agreement with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I would never buy Mercedes-Benz	○	○	○	○	○	○	○
I would seriously consider purchasing Mercedes-Benz	○	○	○	○	○	○	○

Q9: How likely would you be to purchase Mercedes-Benz?

Very unlikely	○	○	○	○	○	○	○	Very likely

Q10: Are you willing to spend more money on automobiles of Mercedes-Benz?

○	Yes
○	No

Question is displayed if Q10 "Yes" is selected.
Q11: How much more are you willing to spend (in %)?

	Nothing at all		A little		A moderate amount			A lot		A great deal
	0	10	20	30	40	50	60	70	80	90	100
Willingness to spend more (in %)											

Block 2 – Yes Electrification / Focus on brands' engagement in electrification

Since the beginning of modern times hybrid research in 1969, Daimler AG heavily invested in developing alternative driving technologies. Mercedes-Benz, as one of the best performing brands of the Daimler AG, already offers a wide variety of electrified vehicles to reduce carbon emissions. Electrified vehicles have a built in power-unit, namely a battery, that is charged with electricity.

As of today, Mercedes-Benz is increasingly gaining momentum with regard to the electrification of the automobile. By 2022, the brand's entire product range is set to be electrified. From small compact cars to large SUVs, Mercedes-Benz will be offering electric alternatives for their customers' individual needs. Hereby, the focus lies on continuously increasing the percentage of all-electric cars in the product range of Mercedes-Benz cars.

Mercedes-Benz new all-electric sedan car

Q4: On a scale from 1 (strongly disagree) to 7 (strongly agree), please rate your level of agreement with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Mercedes-Benz respects moral norms	○	○	○	○	○	○	○
Mercedes-Benz is a socially responsible brand	○	○	○	○	○	○	○
Mercedes-Benz avoids damaging behavior at all costs	○	○	○	○	○	○	○
Mercedes-Benz is a good brand	○	○	○	○	○	○	○

Q5: I perceive Mercedes-Benz to be:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Thoughtful	○	○	○	○	○	○	○
Attractive	○	○	○	○	○	○	○
Confident	○	○	○	○	○	○	○
Human-oriented	○	○	○	○	○	○	○
Reliable and durable	○	○	○	○	○	○	○
Safe	○	○	○	○	○	○	○
Practical	○	○	○	○	○	○	○

Excellent engine	○	○	○	○	○	○	○

Q6: On a scale from 1 (strongly disagree) to 7 (strongly agree), please rate your level of agreement with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
With Mercedes-Benz, I obtain what I look for in an automobile	○	○	○	○	○	○	○
Mercedes-Benz is a brand that meets my expectations	○	○	○	○	○	○	○
Mercedes-Benz would be honest and sincere in addressing my concerns	○	○	○	○	○	○	○
Mercedes-Benz would make any effort to satisfy me	○	○	○	○	○	○	○

Q7: On a scale from 1 (strongly disagree) to 7 (strongly agree), please rate your level of agreement with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I recommend Mercedes-Benz those who ask my advice	○	○	○	○	○	○	○

I say positive things about Mercedes-Benz to other persons	○	○	○	○	○	○	○
I consider this brand my first choice when I want to buy a new automobile	○	○	○	○	○	○	○

Q8: On a scale from 1 (strongly disagree) to 7 (strongly agree), please rate your level of agreement with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I would never buy Mercedes-Benz	○	○	○	○	○	○	○
I would seriously consider purchasing Mercedes-Benz	○	○	○	○	○	○	○

Q9: How likely would you be to purchase Mercedes-Benz?

Very unlikely	○	○	○	○	○	○	○	Very likely

Q10: Are you willing to spend more money on automobiles of Mercedes-Benz?

○	Yes
○	No

Question is displayed if Q10 "Yes" is selected.
Q11: How much more are you willing to spend (in %)?

	Nothing at all		A little		A moderate amount			A lot		A great deal
	0	10	20	30	40	50	60	70	80	90	100
Willingness to spend more (in %)											

Block 3 – Type of electrified vehicle

Transition to type of electrified vehicle

The following part of the survey will introduce you to an electrified vehicle. Please carefully read the information provided and follow the instructions on the next page.

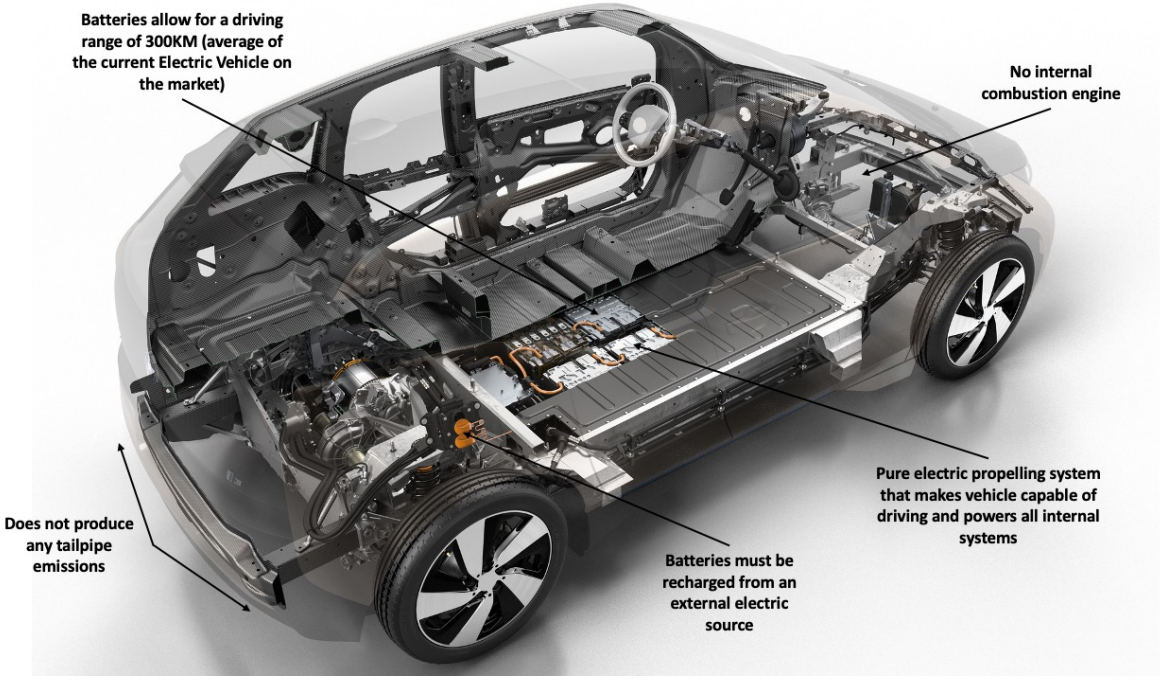
Introduction to EVs / HEVs / PHEVs

The term "electrification" in the automobile context refers to manufacturers continuously introducing new vehicles to the market that are (partly) powered by electricity, namely with the inclusion of batteries.

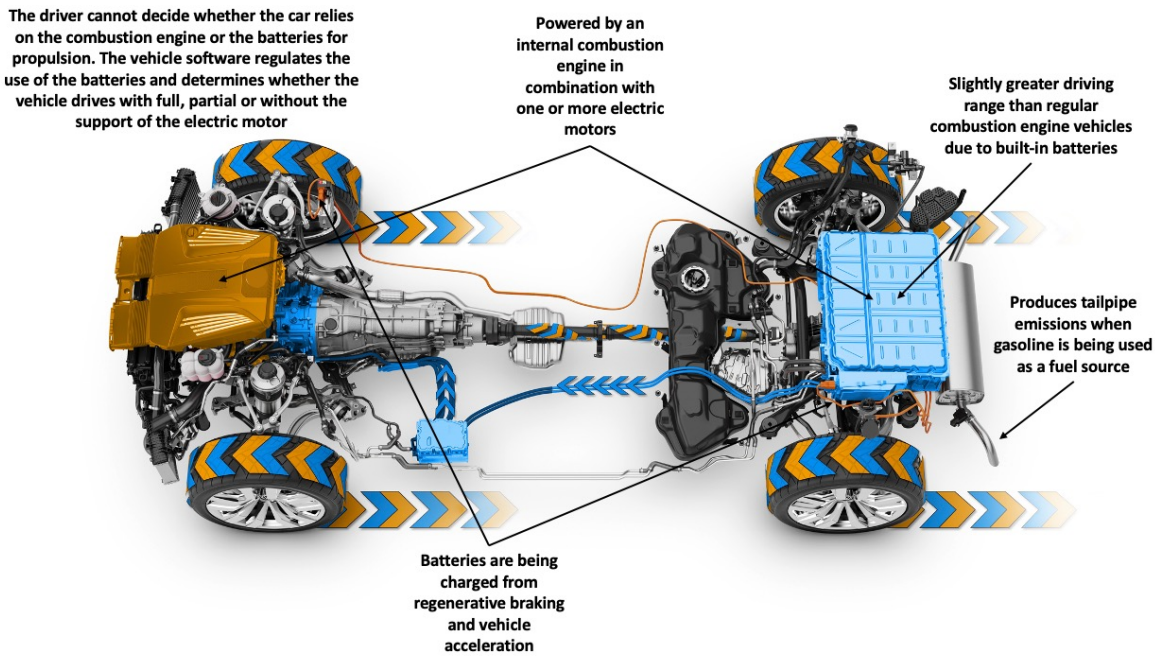
In the picture below, please find a brief description of product-specific attributes and characteristics of an Electric Vehicle (EV)/Hybrid Electric Vehicle (HEV)/Plug-in Hybrid Electric Vehicle (PHEV). After carefully familiarizing yourself with the information, please proceed to the next page.

One of the three following pictures including the text was presented to the participant

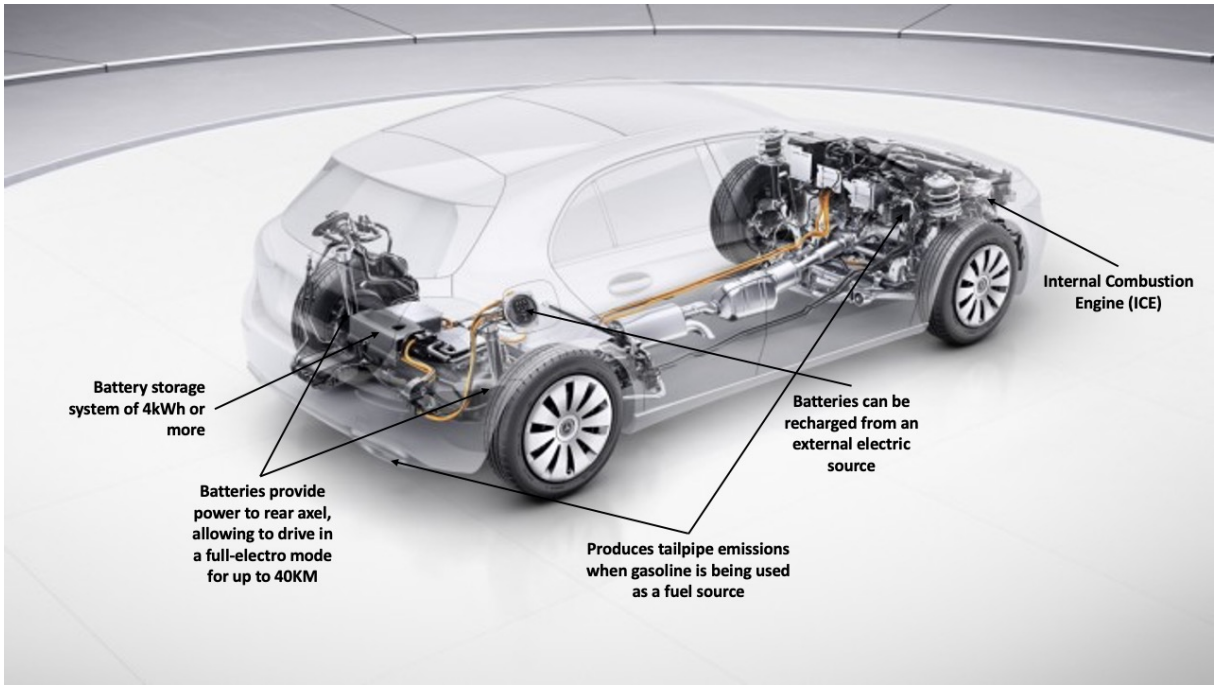
You may only proceed to the next page after clicking the info-boxes in the picture to validate your understanding. The boxes will turn green and you and move forward with the survey.



Electric Vehicle (EV)



Hybrid Electric Vehicle (HEV)



Plug-in Hybrid Electric Vehicle (PHEV)

Transition to the query of questions measuring the dependent variables of the study

Please imagine a scenario where Mercedes-Benz introduces a newly developed EV/HEV/PHEV to their product portfolio. The EV/HEV/PHEV would have the same attributes and characteristics as displayed in the graphic you have just seen. Based on the given information, please answer the hereinafter posed questions.

Q12: On a scale from 1 (strongly disagree) to 7 (strongly agree), please rate your level of agreement with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Mercedes-Benz respects moral norms	○	○	○	○	○	○	○
Mercedes-Benz is a socially responsible brand	○	○	○	○	○	○	○
Mercedes-Benz avoids damaging behavior at all costs	○	○	○	○	○	○	○
Mercedes-Benz is a good brand	○	○	○	○	○	○	○

Q13: I perceive Mercedes-Benz to be:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Thoughtful	○	○	○	○	○	○	○
Attractive	○	○	○	○	○	○	○
Confident	○	○	○	○	○	○	○
Human-oriented	○	○	○	○	○	○	○
Reliable and durable	○	○	○	○	○	○	○
Safe	○	○	○	○	○	○	○
Practical	○	○	○	○	○	○	○

Excellent engine	○	○	○	○	○	○	○

Q14: On a scale from 1 (strongly disagree) to 7 (strongly agree), please rate your level of agreement with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
With Mercedes-Benz, I obtain what I look for in an automobile	○	○	○	○	○	○	○
Mercedes-Benz is a brand that meets my expectations	○	○	○	○	○	○	○
Mercedes-Benz would be honest and sincere in addressing my concerns	○	○	○	○	○	○	○
Mercedes-Benz would make any effort to satisfy me	○	○	○	○	○	○	○

Q15: On a scale from 1 (strongly disagree) to 7 (strongly agree), please rate your level of agreement with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I recommend Mercedes-Benz those who ask my advice	○	○	○	○	○	○	○

I say positive things about Mercedes-Benz to other persons	○	○	○	○	○	○	○
I consider this brand my first choice when I want to buy a new automobile	○	○	○	○	○	○	○

Q16: On a scale from 1 (strongly disagree) to 7 (strongly agree), please rate your level of agreement with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I would never buy Mercedes-Benz	○	○	○	○	○	○	○
I would seriously consider purchasing Mercedes-Benz	○	○	○	○	○	○	○

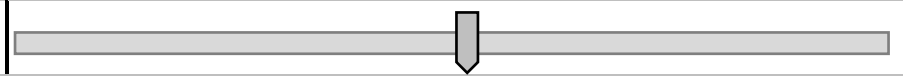
Q9: How likely would you be to purchase a EV/HEV/PHEV of Mercedes-Benz?

Very unlikely	○	○	○	○	○	○	○	Very likely

Q10: Are you willing to spend more money on an EV/HEV/PHEV of Mercedes-Benz?

○	Yes
○	No

Question is displayed if Q10 "Yes" is selected.
Q11: How much more are you willing to spend (in %)?

	Nothing at all		A little		A moderate amount			A lot		A great deal	
	0	10	20	30	40	50	60	70	80	90	100
Willingness to spend more (in %)											

Block 4 – NEP-Scale measurement

Q20: Listed below are statements about the relationship between humans and the environment. For each one, please indicate your level of agreement on a scale from 1 (strongly disagree) to 5 (strongly agree).

	Strongly disagree	Mildly disagree	Unsure	Midly agree	Strongly Agree
We are approaching the limit of the number of people the earth can support	○	○	○	○	○
Humans have the right to modify the natural environment to suit their needs	○	○	○	○	○
When humans interfere with nature it often produces disastrous consequences	○	○	○	○	○
Human ingenuity will insure that we do NOT make the earth unlivable	○	○	○	○	○
Humans are severely abusing the environment	○	○	○	○	○
The earth has plenty of natural resources if we just learn how to develop them	○	○	○	○	○
Plants and animals have as much right as humans to exist	○	○	○	○	○
The balance of nature is strong enough to cope with the impacts of modern industrial nations	○	○	○	○	○
Despite our special abilities humans are still subject to the laws of nature	○	○	○	○	○
Please chose "Mildly disagree"	○	○	○	○	○
The so-called "ecological crisis" facing humankind has been greatly exaggerated	○	○	○	○	○
The earth is like a spaceship with very limited room and resources	○	○	○	○	○
Humans were meant to rule over the rest of nature	○	○	○	○	○
The balance of nature is very delicate and easily upset	○	○	○	○	○

Humans will eventually learn enough about how nature works and be able to control it	∘	∘	∘	∘	∘
If things continue on their present course, we will soon experience a major ecological catastrophe	∘	∘	∘	∘	∘

Block 5 – Demographic questions

Q21: What is your gender?

∘	Male
∘	Female
∘	Non-binary / third gender
∘	Prefer not to say

Q22: What is your age?

∘	0 - 18 years old
∘	19 - 25 years old
∘	26 - 35 years old
∘	36 - 44 years old
∘	45 - 54 years old
∘	55 - 64 years old
∘	65+ years old
∘	Prefer not to say

Q23: What is your occupation?

∘	Worker
∘	Student
∘	Job seeking
∘	Unemployed
∘	Retired

Q24: Please specify your ethnicity.

∘	Caucasian/White
∘	African-American
∘	Latino or Hispanic
∘	Asian
∘	Native American
∘	Two or More
∘	Other/Unknown
∘	Prefer not to say

Q25: Do you own a car?

◦	Yes
◦	No

Q26: Please indicate your driving experience in years.

◦	Up to 5 years
◦	5 – 10 years
◦	More than 10 years
◦	Do not have a driving license

Q27: What is your political orientation?

Far left | ◦ ◦ ◦ ◦ ◦ ◦ ◦ | Far right

Q28: What country do you currently reside in?

▼ Afghanistan * ... Zimbabwe (195)

Q29: What is the highest degree or level of school you have completed?
If currently enrolled, highest degree received.

◦	No schooling completed
◦	Some high school, no diploma
◦	High school graduate, diploma or equivalent
◦	Trade/technical/vocational training
◦	Bachelor's degree
◦	Master's degree
◦	Doctorate degree
◦	Prefer not to say

Q30: What is your marital status?

◦	Single
◦	Married
◦	Widowed
◦	Divorced

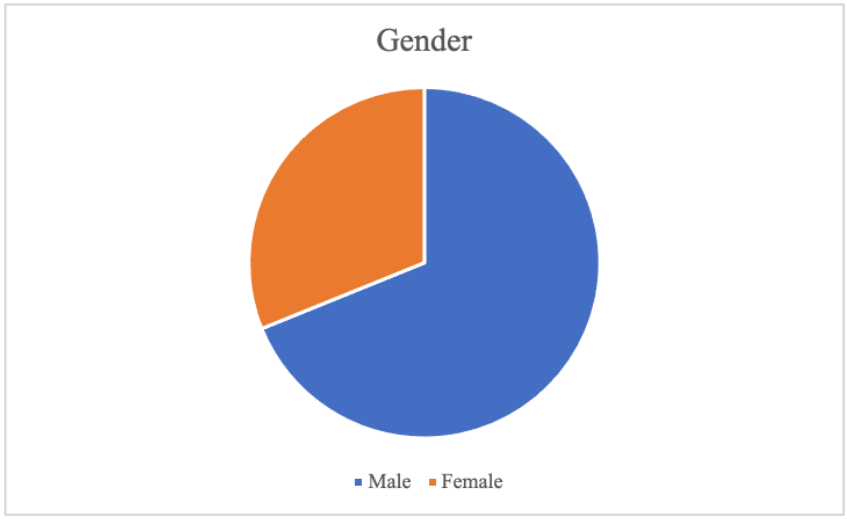
Q31: What is your annual household income after tax?

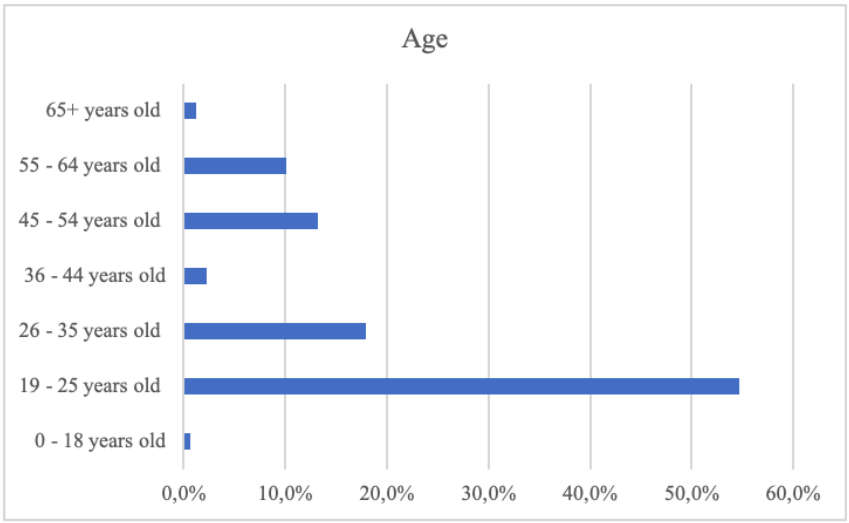
◦	< €15.000
◦	€15.000 - € 25.000
◦	€25.001 - €35.000
◦	€35.001 - €50.000
◦	> €50.000

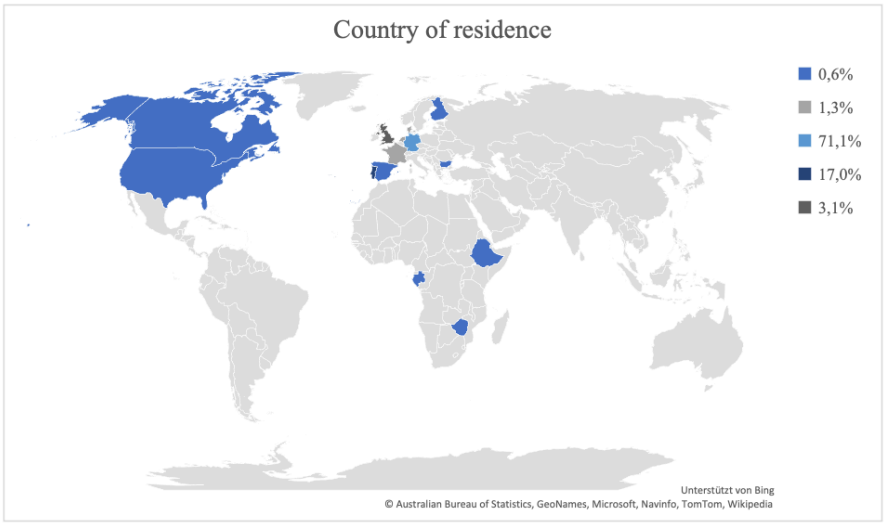
Thank you for your time spent answering this survey. Your response has been recorded.

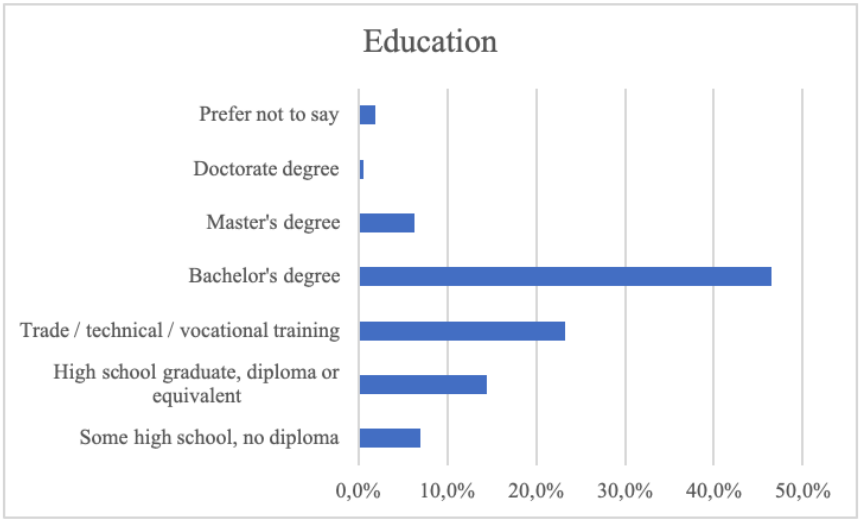
Appendix 7: Sample Characterization

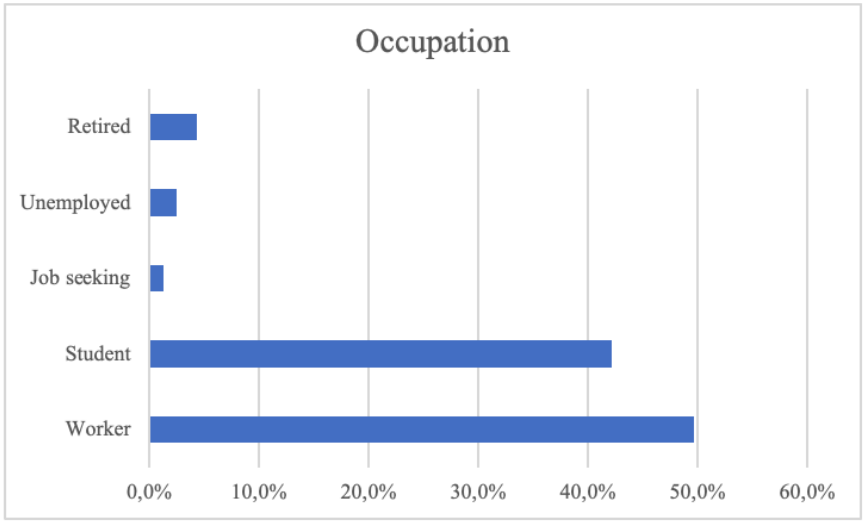
Main study sample characterization

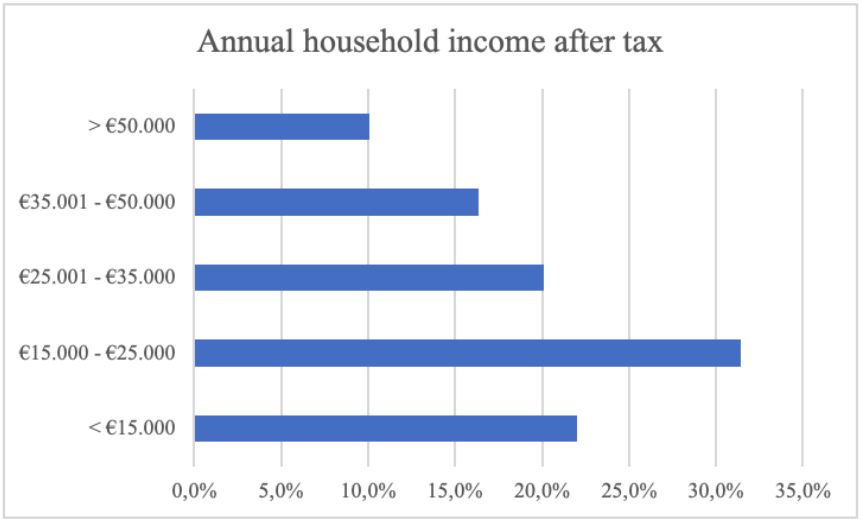







Education
Prefer not to say
Doctorate degree
Master's degree
Bachelor's degree
Trade / technical / vocational training
High school graduate, diploma or equivalent
Some high school, no diploma
0,0%
10,0%
20,0%
30,0%
40,0%
50,0%


Occupation
Retired
Unemployed
Job seeking
Student
Worker
0,0%
10,0%
20,0%
30,0%
40,0%
50,0%
60,0%


Annual household income after tax
> €50.000
€35.001 - €50.000
€25.001 - €35.000
€15.000 - €25.000
< €15.000
0,0%
5,0%
10,0%
15,0%
20,0%
25,0%
30,0%
35,0%

Appendix 8: Scales Reliability

Factor analyses and Cronbach's Alpha on all scales used for the main study

		Factors Extracted	KMO and Bartlett's Test		Scales Reliability	
	Moment of Measurement	Components	KMO	Sig.	Cronbach's Alpha	Items
CPE	No Electrification	1	.76	.00	.85	4
	Yes Electrification	1	.73	.00	.81	4
	EV	1	.75	.00	.89	4
	PHEV	1	.83	.00	.92	4
	HEV	1	.81	.00	.92	4
Brand Image (Symbolic)	No Electrification	1	.65	.00	.93	8
	Yes Electrification	1	.65	.00	.85	8
	EV	1	.78	.00	.94	8
	PHEV	1	.72	.00	.90	8
	HEV	1	.80	.00	.93	8
Brand Image (Functional)	No Electrification	1	.89	.00	.93	8
	Yes Electrification	1	.75	.00	.85	8
	EV	1	.85	.00	.94	8
	PHEV	1	.77	.00	.90	8
	HEV	1	.68	.00	.93	8
Brand Trust	No Electrification	1	.83	.00	.91	4
	Yes Electrification	1	.66	.00	.83	4
	EV	1	.80	.00	.89	4
	PHEV	1	.76	.00	.89	4
	HEV	1	.75	.00	.90	4
Brand Loyalty	No Electrification	1	.75	.00	.91	3
	Yes Electrification	1	.70	.00	.88	3
	EV	1	.68	.00	.92	3
	PHEV	1	.76	.00	.93	3
	HEV	1	.68	.00	.81	3
Purchase Intention	No Electrification	1	.68	.00	.85	3
	Yes Electrification	1	.67	.00	.82	3
	EV	1	.67	.00	.80	3
	PHEV	1	.62	.00	.84	3
	HEV	1	.65	.00	.81	3
NEP Scale	Initial Extraction	4	.71	.00	-	-
	Anthropocentrism	1	-	-	.73	7
	Ecological Conscious	1	-	-	.76	7
	Anti-Exemptionalism	1	-	-	.71	5
	Fear of Crisis	1	-	-	.72	3

Appendix 9: Principal Component Analysis of NEP Items with Varimax Rotation

Principal Component Analysis of NEP Items with Varimax Rotation

	Component			
NEP Scale Item	*1*	*2*	*3*	*4*
1. We are approaching the limit of the number of people the earth can support	-.19	-.06	.08	**.79**
2. Humans have the right to modify the natural environment to suit their needs	**.73**	-.10	-.18	-.17
3. When humans interfere with nature it often produces disastrous consequences	**-.59**	.08	**.86**	.14
4. Human ingenuity will insure that we do NOT make the earth unlivable	**.71**	-.11	.18	-.24
5. Humans are severely abusing the environment	.03	**.71**	.09	.18
6. The earth has plenty of natural resources if we just learn how to develop them	**.32**	-.15	**.71**	.02
7. Plants and animals have as much right as humans to exist	**-.46**	.14	**.63**	-.26
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations	**.43**	**-.35**	-.20	**-.42**
9. Despite our special abilities humans are still subject to the laws of nature	.08	**.60**	.04	-.20
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated	.08	**-.40**	**-.56**	**-.36**
11. The earth is like a spaceship with very limited room and resources	-.19	**.66**	-.13	.16
12. Humans were meant to rule over the rest of nature	**.60**	-.29	-.23	**.41**
13. The balance of nature is very delicate and easily upset	-.25	**.74**	.09	-.23
14. Humans will eventually learn enough about how nature works to be able to control it	**.77**	.07	.11	-.08
15. If things continue on their present course, we will soon experience a major ecological catastrophe	-.23	**.54**	**.35**	**.45**

Appendix 10: Two-way MANOVA

Brands' Engagement in Electrification x Type of Electrified Vehicle Two-Way MANOVA

	Electrification main effect	Type of electrified vehicle main effect	Electrification* type of electrified vehicle
	F test	*F test*	*F test*
CPE (pre 2nd stimulus)	22.19***	4.35*	1.78
CPE (post 2nd stimulus)	1.07	20.98***	.01
ΔCPE	9.31***	30.00***	1.45
Brand_Image_Symbolic (pre 2nd stimulus)	47.97***	4.02*	1.65
Brand_Image_Symbolic (post 2nd stimulus)	.17	17.16***	.12
ΔBrand_Image_Symbolic	34.03***	28.67***	.66
Brand_Image_Functional (pre 2nd stimulus)	8.12***	.20	.56
Brand_Image_Functional (post 2nd stimulus)	.09	15.68***	.88
ΔBrand_Image_Functional	8.44****	17.87***	.55
Brand_Trust (pre 2nd stimulus)	24.36***	1.55	1.05
Brand_Trust (post 2nd stimulus)	.01	21.47***	.12
ΔBrand_Trust	22.58***	22.20***	.63
Brand_Loyalty (pre 2nd stimulus)	2.56	.50	.23
Brand_Loyalty (post 2nd stimulus)	.50	10.68***	1.31
ΔBrand_Loyalty	5.43*	12.42***	1.36
Purchase_Intention (pre 2nd stimulus)	24.76***	1.85	.54
Purchase_Intention (post 2nd stimulus)	2.28	13.54***	1.30
ΔPurchase_Intention	14.73***	5.90**	.56

Note: ***$p < .001$, **$p < .01$, *$p < .05$, +$p \leq .1$

Appendix 11: Two-way MANCOVA including NEP Items as Covariates

Brands' Engagement in Electrification x Type of Electrified Vehicle Two-Way MANCOVA with NEP-Scale Extracted Factors as Covariates

	Electrification main effect	Type of electrified vehicle main effect	Electrification* type of electrified vehicle
	F test	*F test*	*F test*
CPE (pre 2nd stimulus)	22,22***	5,16*	1,49
CPE (post 2nd stimulus)	1,67	27,56***	,40
ΔCPE	8,42**	35,13***	1,73
Brand_Image_Symbolic (pre 2nd stimulus)	46,37***	4,36*	1,82
Brand_Image_Symbolic (post 2nd stimulus)	,20	19,80***	,05
ΔBrand_Image_Symbolic	32,95***	29,85***	1,06
Brand_Image_Functional (pre 2nd stimulus)	6,75**	,40	,47
Brand_Image_Functional (post 2nd stimulus)	,16	18,45***	1,60
ΔBrand_Image_Functional	7,83**	22,03***	1,46
Brand_Trust (pre 2nd stimulus)	22,54***	2,11	,90
Brand_Trust (post 2nd stimulus)	,00	25,11***	,34
ΔBrand_Trust	22,12***	23,77***	,19
Brand_Loyalty (pre 2nd stimulus)	2,33	,46	,10
Brand_Loyalty (post 2nd stimulus)	,53	13,68***	2,34
ΔBrand_Loyalty	5,33*	15,63***	2,40
Purchase_Intention (pre 2nd stimulus)	24,24***	1,60	,37
Purchase_Intention (post 2nd stimulus)	2,41	14,77***	1,66
ΔPurchase_Intention	14,34***	6,61**	,52

Note: ***$p < .001$, **$p < .01$, *$p < .05$, +$p \leq .1$

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