Has Tesla influenced consumer perceptions of electric vehicles? Insights from a survey of Canadian car buyers

by

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Ethics Statement

The author, whose name appears on the title page of this work, has obtained, for the research described in this work, either:

a.   human research ethics approval from the Simon Fraser University Office of Research Ethics

or

b.   advance approval of the animal care protocol from the University Animal Care Committee of Simon Fraser University

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Abstract

The reduction of greenhouse gases (GHGs) is vital for the mitigation of negative climate change impacts. Battery electric vehicles (BEVs) could serve as a key element to reduce GHGs. Therefore, an increased uptake in the adoption of BEVs is vital if we are going to meet our climate goals. In this research, I explore consumer awareness and perceptions of brands that produce BEVs, including incumbent automakers, as well as Tesla, a relatively new BEV-focused automaker. Among the broad literature of consumer research on battery electric vehicles (BEVs), little weight is placed on the role of automaker brand. Drawing from marketing literature, I note that consumers might prefer the automotive brands that they are familiar with, due to brand loyalty. Alternatively, they might prefer Tesla for being more innovative, affording it a pioneer advantage. I study the role of brand using survey data collected from a representative sample of 2,123 Canadian new vehicle-buyers in 2017. Findings reveal that respondents most frequently associate BEVs with Tesla (27% of respondents), Toyota (27%), Chevrolet (26%), and Nissan (13%). More than two-thirds of respondents are familiar with Tesla, and 40% select Tesla as a brand representing the "future of BEVs". In contrast, when asked which brand they would refer to buy a BEV from, responses are more evenly spread across a variety of brands, with more selecting Honda (31%) and Toyota (30%). Of the Tesla-familiar respondents, most reference that Tesla has influenced them to perceive BEVs in positive ways, such as being more innovative, stylish, and environmentally beneficial. Similarly, respondents associate Tesla with images of being more powerful, attractive, and trendy, relative to BEVs in general. These findings could be associated with intent to purchase a BEV considering that 51% of the Tesla familiar respondents indicated that Tesla was increasing their interest to purchase a BEV. These exploratory findings suggest that Tesla has contributed to shaping consumer perceptions of BEVs.

Keywords: Electric vehicle; brand awareness; Tesla; consumer research; survey

Dedication

For Bella, I lost you on this journey, but gained you forever in my heart.

Acknowledgements

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List of Acronyms

BEV	Battery Electric Vehicle
ICE	Internal Combustion Vehicle
PEV	Plug-in Electric Vehicle
PHEV	Plugged-in Hybrid Electric Vehicle

Chapter 1.

Introduction

Battery electric vehicles (BEVs) could be an important technology for mitigating greenhouse gas (GHG) emissions produced via transportation, particularly in the passenger vehicle sector. Transportation researchers suggest that 80-90% of new vehicle sales must be non-GHG emitting by 2050 to meet climate mitigation targets (Bahn et al, 2013; McCollum and Yang, 2009). Some countries, such as Canada, have committed to increase BEV market share to 30% by 2030 to reduce transportation-related GHG emissions (Clean Energy Ministerial, 2017). Most major automakers have developed (or are in the process of developing) BEVs to sell in their fleets (Reichmuth and Anair, 2016). Still, BEV offerings from automakers remain restricted, and plug-in electric vehicles (PEVs) new market share is only 1-2% in most developed countries (Strasser et al., 2018).

There has been much discussion around the topic of GHG reductions, with some asserting that acceptance of new technologies is influenced by an individual's level of concern for climate change (Jobin and Siergrist, 2018). However, the assumption is often made that a concern or interest in GHG emission reduction alone might lead drivers to trade in their internal combustion engines (ICE) for a BEV (Graham-Rowe et al 2012). However, car buyers can have a variety of motivations for their purchases, such as interest in pleasure and enjoyment in driving (Abraham, 2006; Gardner and Abraham, 2007; Steg, 2005). The motivation for pleasure and enjoyment can also relate to the desire to indicate social position and express identity (Ajzen, 1991; Davis et al, 1989). Research has also shown that interest in BEVs is associated with interest in technology and practicality (Axsen et al., 2018).

In the consumer vehicle market, brand names play an important role in purchase behaviour – yet few studies consider the role of brand in consumer perceptions of BEVs, as discussed below. Vehicle quality can be difficult to evaluate before purchasing. Therefore, brands provide value signals to consumers and help reduce the risk of making a bad purchase decision by promising a certain quality level (Baltas et al., 2017; Keller and Lehmann, 2006). Further, passenger vehicles act as symbols to consumers,

often used to express identity, beliefs, and values (Heffner et al., 2007), and vehicle brand choice can be an extension of such symbolic statements (Moons and De Pelsmacker, 2016). Given the lack of insights in this area, this paper focuses on consumer perceptions of brand in relation to BEVs.

This analysis includes a specific focus on the case of Tesla, Inc. (formerly Tesla Motors, which I refer to as "Tesla" from here on). Founded in 2003, Tesla manufactures and sells BEVs, batteries, energy storage devices, and rooftop solar panels (Mangram, 2012). In 2015 and 2016, Tesla's Model S was the best-selling BEV, globally (Cobb, 2018). For 2018, the Tesla Model 3 was the most successful BEV introduction ever, with 2,785 unit sales noted in the second quarter (Schmidt, 2018). Compared to traditional automakers (e.g., Ford or GM), Tesla's business strategy is distinctive in several ways. First, it is the only automaker to exclusively sell highway-capable BEVs, whereas other automakers tend to offer one or a few BEV models alongside their fleet of conventional vehicles, and potentially PHEVs and hybrid vehicles (Reichmuth and Anair, 2016). Second, Tesla's supply chain has a high degree of vertical integration, from manufacturing its own batteries and components in large factories, to owning and operating its proprietary "superchargers" (Bilbeisi and Kesse, 2017). Additionally, Tesla avoids the franchised dealership model of traditional automakers and instead operates retail stores and showrooms staffed by Tesla employees who can help prospective buyers place online orders (Mangram, 2012). Last, Tesla has an intentional public relations strategy of maximizing media coverage around its company, one which emphasizes their position as a BEV innovator (Mangram, 2012). For these reasons, Tesla stands apart from other automakers. But has this demarcation manifested in consumer perceptions of Tesla? Has Tesla influenced perceptions of BEVs more generally?

There has been little exploration around brand and BEVs. Because of this, I first discuss consumer perspectives of BEVs, provide some context of PEV sales in Canada and then draw from concepts in the broader literature that might help explain the importance of brand and its effect on interest for BEVs. I then use survey data to investigate consumer perceptions towards Tesla and BEVs in general, while focusing on potential insights and concepts regarding brand.

1.1. Consumer perceptions of BEVs

Substantial research efforts have focused on gauging consumer interest in, and preferences for, BEVs (and other alternative fuel vehicle technologies) to inform stakeholders about the consumer market and predict demand for BEVs. Rezvani et al (2015) provide a review of BEV consumer research, identifying five broad theoretical perspectives that have been commonly applied: i) rational choice, ii) pro-environmental and normative-based theories, iii) identity and lifestyle, iv) innovativeness (including Diffusion of Innovations), and v) emotions-based theories. None of these relate to brand perception, as specific focus on brands is lacking in literature. However, some insights about consumer perceptions more generally might carry over to perceptions of brand. For example, interest in BEVs has been found to be positively associated with pro-environmental consumer characteristics, such as engagement in an environment-oriented lifestyle, having biospheric values, and having concern for the environment (Axsen et al., 2018; Noppers et al., 2014). Similarly, some studies find that consumers who are more technology-oriented or who score higher on the trait of "innovativeness" are more likely to be interested in BEVs (Axsen et al., 2015; Hardman et al., 2017; Jansson, 2011; Kurani et al., 2016). Potentially, an automotive brand that is more associated with being pro-environmental, more innovative, or perhaps both, might have more of a positive influence on consumer perceptions of BEVs.

To help explore different dimensions of perceptions of BEVs and Tesla, I draw from a framework that categorizes the attributes, or perceived benefits, of pro-environmental technologies by functional, symbolic, and societal dimensions (Axsen et al., 2018; Axsen and Kurani, 2012; Axsen et al., 2017). Functional attributes refer to a technology's use and operation, such as cost and performance. Societal attributes are those that extend beyond the user to benefit society more broadly, for example reducing air pollution and greenhouse gas emissions. Last, symbolic attributes express meaning or identity. For example, a vehicle model might convey the image of intelligence, or "the future" (Axsen and Kurani, 2012). In the examination of consumer perceptions of brand, and Tesla specifically, I use this framework to help differentiate types of attribute perceptions that consumers might associate with Tesla. I hypothesize that Tesla could influence attribute perceptions of BEVs in all three categories: functional (e.g., vehicle performance and cost), societal (e.g., environmental impacts, as well as ability to induce

a broader shift to low-carbon vehicles), and symbolic (representing "the future", being "innovative" or "successful").

1.2. Context: Plug-in electric vehicle sales in Canada

Because I focus on the case study of Canada, I provide a brief summary of PEVs – which include BEVs as well as other zero emission vehicles (ZEVs) – sales and trends in the region. PEVs first came to market in Canada in 2011, where the Nissan Leaf (a BEV) and the Chevrolet Volt (a PHEV) were among the first three models available for sale (in addition to the Smart Electric Drive) and PEV new market share was just 0.03% (IEA, 2018). By 2017 (the year of data collection), PEV new market share had grown to 1.1%, and 34 models were available for purchase.

In comparison, by the end of September 2018, there had been 34,357 PEVs purchased in the Canadian market, with a close split of 16,657 sales for BEVs and 17,700 sales for PHEVs for the year (Schmidt, 2018). This was an increase of 158% compared to the same time for the previous year (Schmidt, 2018). The Tesla model 3 was noted as the top seller for the third quarter of 2018, with 2,070 sales nationwide.

In British Columbia, Canada, several new commitments have been made regarding clean transportation via the CleanBC initiative. One of them, is BC's commitment to 30% of all sales of new light duty cars and trucks being ZEVs by 2030, and rising to 100% of sales by 2040. The province is also committed to new GHG emission targets of 40% by 2030, 60% by 2040 and 80% by 2050 (CleanBC, 2018). For the success of these initiatives, consumers will need to actually prefer these vehicles when shopping for a vehicle, which creates the need to understand the consumer market for BEVs.

1.3. Conceptual framework: Vehicles and brand

Concepts in the marketing literature may help to explain how particular automotive brands, such as Tesla, could be set apart from other automakers in the public consciousness. I choose to focus on a conceptual framework that pulls together several concepts: brand equity, pioneer brand advantage, brand loyalty, brand

awareness, and the halo effect. Table 1 provides a summary of each concept, its definition, and what I expect to see in my analysis.

Table 1.   **Concepts**

Concept	Definition	Hypothesis
Pioneer Brand Advantage	Explains consumers' preference for the first brand to produce and sell a new product (Alpert and Kamins, 1994; Alpert and Kamins, 1995).	I expect to see consumer's exhibit preference for Tesla as a pioneer brand for BEVs.
Brand Loyalty	Suggests that consumers exhibit preference for brands they have experience with (either directly or indirectly), which can be manifested in their attitudes towards brands as well as their purchase behaviour (Jacoby and Chestnut, 1978; Romaniuk and Nenyez-Thiel, 2013).	When asked to state the vehicle they would most likely make a purchase from, I expect I might see preference for brands consumers have already owned and/or are very familiar.
Brand Awareness	Defined as the personal meaning about a brand stored in consumer memory (Keller, 2003). Brand awareness relates to the likelihood that a brand will come to mind and how easily it does so (Keller, 1993).	I expect to see high levels of awareness of Tesla as a brand that respondents are able to name easily.
Halo Effect	Defined generally as a type of cognitive bias (Tiffin and McCormick, 1965). The halo effect describes how some consumers may be unable to rate a brand independently on its different characteristics due to the cognitive bias towards the brand itself (Fandos et al., 2011; Foroudi, 2019; Madden et al., 2012).	I expect that I will see positive perceptions of Tesla. For example, responses that indicate Tesla is "pro-environmental" without consumers being able to give specifics on model types.

First is brand equity, which explains the value of a product derived from its brand, regardless of its attributes – it can be thought of as a set of assets and liabilities associated with a particular brand (Aaker, 1991). Brand equity is also defined as the degree to which a brand's name alone contributes to consumers' perceptions of its value (Leuthesser et al, 1995). Branding itself is an important company asset, as a strong brand is indicative of a leverage against competitors, which directly translates into greater revenue generating power (Kotler and Keller, 2006). Companies strongly push marketing efforts that have a positive effect on brand equity (Aaker,1991; Baldauf et al.,

2009; Yoo et al., 2000). Tools that impact public relations, symbols, and company image, positively contribute to consumer ratings of perceived brand quality (Keller, 1993).

A second concept, pioneer brand advantage explains consumers' preference for pioneer brands, defined as the first brand to produce and sell a new product (Alpert and Kamins, 1994; Alpert and Kamins, 1995). Research has shown that consumers have stronger loyalty to pioneer brands, can better recall pioneer brands than follower brands, and have a more favourable attitude towards pioneer brands (Alpert and Kamins, 1995). Pioneer brands also tend to have greater levels of familiarity among consumers and are seen to be more reliable, relative to other brands (Alpert and Kamins, 1994). Given that Tesla was the first automaker to produce and sell only BEVs, as well as its public image as a BEV leader and innovator, Tesla may benefit from pioneer brand advantage, relative to other automakers that sell BEVs. That said, some consumers might perceive other automakers as being pioneer brands, such as Chevrolet (or GM) due to the earlier release of the Volt (a PHEV) in 2010, or Toyota due to the Prius (a hybrid electric vehicle), which was first made available for sale in some markets in the late 1990s, and more widely available in the early 2000s. However, sustaining pioneer brand advantage can be challenging. Pioneer brands usually earn higher market shares (Kalyanaram et al., 1995; Liberman and Montgomery, 1998) .I would expect to see consumer's exhibit preference for some pioneer brands such as Chevrolet and Toyota.

The third concept I consider is brand loyalty. Brand loyalty is the commitment a consumer has to continue to purchase from a brand despite the efforts of other brands to influence consumers to purchase their brands instead (Oliver, 1999). This lack of switching behavior creates the "loyalty". Brand loyalty theory, therefore, also suggests that consumers exhibit preference for brands they have experience with (either directly or indirectly), which can be manifested in their attitudes towards brands as well as their purchase behaviour (Jacoby and Chestnut, 1978; Romaniuk and Nenyez-Thiel, 2013). This is especially true when consumers have favourable experiences with high-involvement products (Muhlbacher et al., 2016), such as vehicles. Research finds that consumers show strong brand loyalty in their vehicle purchases and are more likely to buy vehicles from brands from which they have already purchased (Moons and De Pelsmacker, 2015; Nayum and Klockner, 2014; Train and Winston, 2007). Most vehicle consumers have experience with automakers other than Tesla, given that Tesla is so

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new and has a low market share (for light-duty-vehicles more generally) relative to other automakers, such as Ford and GM. This possible pre-existing brand loyalty to other automakers could negatively impact Tesla as consumers might be loyal to brands with which they are already familiar. Conversely, increases in Tesla sales suggests that Tesla is challenging the loyalty to some of the older auto brands and consumers are switching brands.

A fourth concept is brand awareness, defined as the personal meaning about a brand stored in consumer memory (Keller, 2003). Brand awareness relates to the likelihood that a brand will come to mind and how easily it does so (Keller, 1993). A higher degree of awareness is associated with the possibility that consumers will choose to purchase from that brand (Macdonald and Sharp, 2000). This advantage leads to a direct competitive position to the brand when compared to alternatives. The ability of awareness to affect perceptions is a powerful tool for brands. Brand awareness is important since not only does it strengthen the brand, but it also impacts the consumer attitude to the brand by creating the source of belief and association (Aaker, 1991). Consumers lean towards the familiar, and the brands they identify with (Macdonald and Shark, 2000). This might mean when asked to indicate a brand they would most likely purchase a BEV, that consumers would choose the brand they are most familiar.

Fifth is the "halo effect", which is generally a type of cognitive bias (Tiffin and McCormick, 1965). For this research on brands, it is defined as a tendency for consumers' impression of one attribute to dominate their overall impression and attitude about a brand (Raggio et al., 2014). The halo effect describes how some consumers may be unable to rate a brand independently on its different characteristics due to the cognitive bias towards the brand itself (Fandos et al., 2011; Foroudi, 2019; Madden et al., 2012). Research has observed halo responses in consumer perceptions of a brand's product quality and corporate social responsibility (Madden et al., 2012). From a halo effect perspective, a consumer might perceive Tesla as being innovative, and also assume that it is pro-environmental, high-performance, and efficient. This awareness of a brand, such as Tesla, and favourable associations for certain characteristics (e.g., high performance) has a critical role in comparisons of competing products and consequent vehicle purchase (Leuthesser et al., 1995). Ultimately, this halo effect can potentially lead consumers to purchase a vehicle from an automobile brand when they may have

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little knowledge or awareness of the product itself, simply because of positive associations with the brand (Raggio et al. 2014).

In short, my conceptual framework might predict that consumers have a largely positive association with Tesla – as a pioneer brand, as a brand with high levels of awareness, and/or through a possible halo effect – due to its media exposure, and its overall (potential) association with pro-environmental benefits or perhaps innovation more generally. Alternatively, concepts of brand loyalty and brand equity might predict that consumers may be cautious about Tesla, instead favouring mainstream automakers with which they have more experience (or that they have owned or currently own vehicles from). In this study, I specifically look for indications of brand loyalty, brand awareness, brand equity, pioneer advantage, and a possible halo effect by evaluating consumer responses to Tesla and BEVs in general _____.

1.4. Research objectives

To my knowledge, no research to date has investigated how consumers associate BEVs with particular automaker brands, nor has any examined consumers' perceptions of Tesla. Therefore, I examine conceptual frameworks such as brand equity, pioneer brand advantage, brand loyalty, brand awareness, and the halo effect .Given the lack of literature on the topic of BEV perceptions and brand, this study is largely exploratory. As such, my objectives are to:

1. Assess the degree to which consumers associate BEVs with particular vehicle brands,

2. Identify evidence of pioneer brand advantage and/or brand loyalty,

3. Assess consumer awareness of Tesla in general, and with specific aspects of Tesla (e.g. Tesla's models, CEO and Powerwall), and

4. Compare consumer perceptions of Tesla with perceptions of BEVs, in general, and identify whether or not Tesla has increased interest in purchasing/leasing a BEV.

Chapter 2.

Method

2.1. Survey Instrument

To explore my research objectives, I analyze data collected in the Canadian Zero-Emissions Vehicle Survey (CZEVS), a web-based survey instrument, implemented by the Sustainable Transportation Action Research Team (START) in 2017. CZEVS follows the "Reflexive Participant" approach to survey design, which involves a three-part process to intentionally prompt respondents to "reflect" on ZEV technology, including PHEVs, BEVs, and hydrogen fuel cell vehicles. Part 1 of CZEVs is a 25-35 minute survey, which includes questions to assess background information related to ZEV interest and household information (e.g., vehicle driving habits, demographics, lifestyles, and values). Part 2 is a "Zero-emissions Vehicle Buyers' Guide", a document designed to help respondents learn about ZEV technologies and their attributes, via accessible text, visual aids, and the provision of answers to frequently asked questions about ZEVs. Part 3 is another 25-35 minute survey, completed at least 24 hours after Parts 1 and 2. It includes questions and exercises used to explore and quantify consumer preferences for, perceptions of, and interest in all three ZEVs, as well as to assess perceptions of vehicle brands and Tesla. The survey instrument is described in more detail elsewhere (Long et al., 2019), however, Figure 1 provides the layout of the survey.
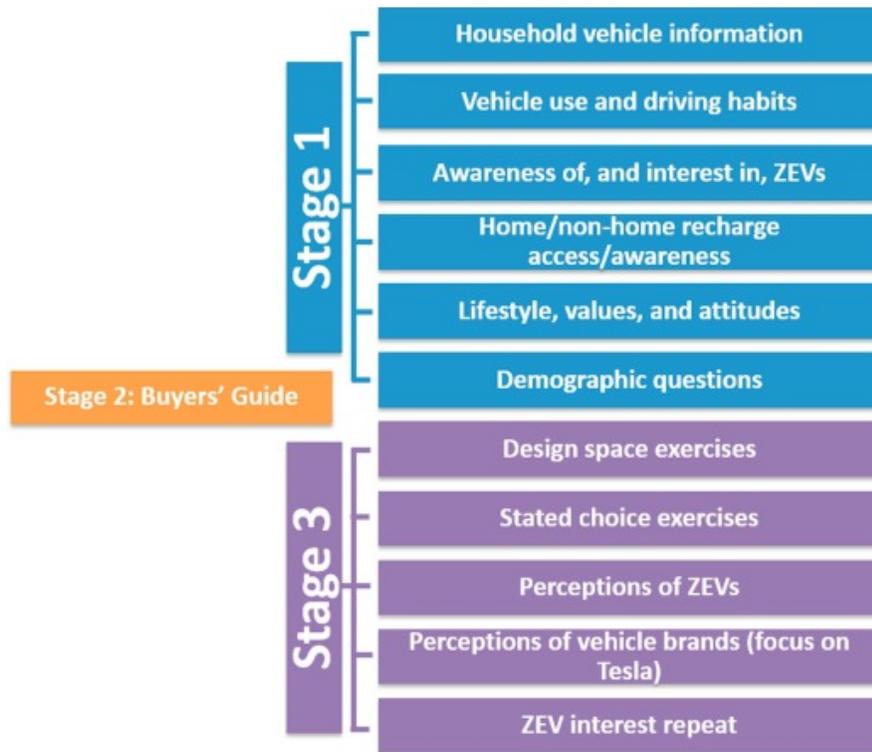
Figure 1.   Overview of CZEVs (Long, 2019)

In this paper, I focus specifically on survey sections and questions related to perceptions of BEVs, automotive brands, and Tesla. I analyze responses to the following questions, which were asked in the following sequence of the CZEVS instrument:

Part 1

1. "*Make of your current household vehicle*": Respondents were asked to provide their current household vehicles by make and model.

2. "*Can you name the make and model of at least one vehicle powered partially or completely by electricity, or powered by hydrogen, that is currently being sold in Canada? Please name as many makes and models as you can.*": Respondents were asked to indicate as many makes and models of zero-emissions vehicles as they could in an open-ended format.

Part 2

3. *"Would you be more likely to buy/lease a battery electric vehicle if it were made by…":* Respondents were presented with a list of vehicle brands and asked to select all brands they would be more likely to purchase a BEV from.

4. *"Which of the following automotive brands best represents the 'future of battery electric vehicles'?":* Respondents selected one brand from the same list presented as in item #2).

5. *"How familiar are you with Tesla?":* Respondents answered on a five-point scale ranging from "*I've never heard of it*" (1) to "*very familiar*" (5).

6. *"How familiar are you with the following aspects of Tesla?":* Respondents were presented with a list of different aspects of Tesla and indicated their familiarity on a five-point scale ranging from "*I've never heard of it*" (1) to "*very familiar*" (5).

7. *"Tesla has increased my belief that battery electric vehicles…"*: Respondents were presented with 18 belief items and indicated their agreement on a five-point scale ranging from "*strongly disagree*" (1) to "*strongly agree*" (5). Items related to different attribute categories noted in Section 3.4 (i.e., functional, societal, and symbolic).

8. "*I associate Tesla with the image of being…*": Respondents were presented with a list of 22 images and indicated their level of agreement on a five-point scale ranging from "*not at all*" (1) to "*very much*" (5). Earlier in the survey, respondents were asked about the images they associate with BEVs, in general, and were presented with the same image items and five-point scale. Images related to different attribute categories noted in Section 3.4 (i.e., functional, societal and symbolic).

9. *"How likely is your household to buy/lease a battery electric vehicle within the next year?"* Respondents indicated their certainty as a percentage, ranging from "*Not at all likely (0%)*" to "*Completely certain (100%)*".

10. "Tesla has ___my interest in purchasing/leasing a battery electric vehicle?" Respondents were asked to fill in the blank using a five-point scale ranging from "*greatly decreased*" (1) to "*greatly increased*" (5).

Questions 6-10 were only asked to respondents who answered that they are "*somewhat familiar", "moderately familiar",* or "*very familiar*" with Tesla, and I focus the majority of my analysis on this subset of "Tesla-familiar" respondents. Where applicable, I indicate if my analysis includes the full sample or the "Tesla-familiar" subsample. Other results from CZEVs are reported elsewhere (see Long et al., 2019 and Kormos et al., 2019).

For the following analyses, I use descriptive analysis to demonstrate how consumers associate BEVs with specific brands, as well as BEV perception in general.

My analysis is meant to be exploratory and does not include statistical analysis, and therefore I am unable to make any firm conclusions on any findings. For each question, I analyze the data provided from the survey and offer a count based on respondents' answers. By summarizing the data in this manner, I identify overall patterns in responses. I then used frequency distributions to display the data. This allowed for ease of interpretation, especially considering the volume of data associated with the questions.

Chapter 3.

Results

3.1. Data collection

CZEVS was implemented in the first half of 2017, targeting Canadian new vehicle-buying households. The sampling frame was households who intended to buy or lease a new vehicle within 12 months of completing the survey. The sample was recruited by a market research company, and respondents were provided with a CAD $20 incentive for completing all parts of the survey. The provinces of British Columbia, Ontario, and Quebec were oversampled to allow for regional comparisons (which is not the focus of this research). To correct for regional oversamples, the appropriate calculations and weights were applied to the analyses herein. In total, 2,123 respondents are included in the final sample.

Because demographic data on the target population is not accessible, I compare the sample to the most recently available Canadian Census data (Table 2). Compared to the Canadian population, the sample is slightly older and has higher education and household income levels, which is typical of new vehicle-buying households (e.g., as found by (Axsen et al., 2015; Axsen and Kurani, 2013). The sample also has a slightly higher proportion of males and home ownership than the general Canadian population.

I also compare the demographics of two subsets of the sample: respondents who state that they are familiar with Tesla (n = 1,500) and those who state that they are not (n = 623). While these subsets are fairly similar in terms of demographic distributions, those who are Tesla-familiar exhibit higher levels of income, education, and residence ownership, and appear more likely to be male, compared to those who are Tesla-unfamiliar.

Table 2.   Demographic characteristics of Canadian Census, CZEVS sample, and respondents familiar and unfamiliar with Tesla

	Canadian Census	CZEVS Sample	Tesla-familiar	Tesla-unfamiliar
Sample Size		2,123	1,500	623
Population size	35,151,728			
Age (of person filling out the survey)				
<35	30%	24%	24%	25%
35-44	16%	18%	18%	18%
45-54	17%	21%	21%	19%
55-64	17%	22%	22%	23%
65+	20%	15%	16%	14%
Household income (pre-tax)				
<$40,000	26%	16%	13%	23%
$40,000-$59,999	16%	19%	19%	18%
$60,000-$89,000	20%	25%	25%	25%
$90,000-$124,999	16%	22%	22%	20%
$125,000+	22%	19%	22%	15%
Highest level of education completed (of person filling out the survey)				
Other	45%	18%	15%	23%
College or diploma	42%	34%	31%	37%
University degree (Bachelor)	16%	30%	33%	27%
Graduate or professional degree	8%	18%	22%	13%
Gender				
Male	49%	57%	60%	48%
Female	51%	43%	30%	52%
Residence type				
Detached House	59%	65%	63%	64%
Attached House	12%	12%	13%	11%
Apartment	28%	22%	23%	25%
Mobile Home	1%	1%	1%	1%
Residence ownership				
Own	68%	77%	78%	72%
Rent	32%	23%	22%	28%
Number of people per household				
1	28%	19%	20%	20%
2	34%	42%	41%	42%
3	16%	20%	20%	18%
4+	23%	20%	19%	20%

2016 Canadian Census data available from: https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E

3.2. Consumer perceptions of BEV brands (full sample, n = 2,123)

I first summarize brand perceptions across the entire sample (n = 2,123), starting with an open-ended question asking respondents to name at least one make and model of a PEV sold in Canada. By having an open-ended response format, respondents were not provided with any brand names, meaning that they would have to reference brands stored in their memories. Recall that brand awareness relates to the likelihood that a particular brand will come to mind, and how easily it does so. Therefore, I infer that the brands that respondents mention are those that came to mind first and reflect a relatively high level of awareness in the minds of those consumers. Additionally, familiarity with brand can also be a result of pioneer advantage, since pioneer brands tend to have greater levels of familiarity among consumers (Alpert and Kamins, 1994).

Figure 1 displays the frequency at which each brand was mentioned, organized by which brands sold PEVs in Canada (at the time of data collection in the first half of 2017). For this question, one respondent could mention multiple makes and models if they chose to do so. Approximately 27% of respondents mentioned Tesla (mostly the Model S), 26% mentioned Chevrolet (mostly the Volt), and 13% mentioned Nissan (mostly the Leaf). Mentions of Toyota were 27% and were mostly the Prius (hybrid), which is not a PEV, demonstrating that respondents associate Toyota with electrified drivetrains. Perhaps providing further confusion to respondents, Toyota has at times sold a plug-in hybrid version of the Prius (the Prius Prime) in Canada, from 2012-2015, and again in late 2017, after data collection. Around 38% of respondents mentioned brands that did not sell PEVs in Canada at the time of data collection.

"Can you name the make and model of at least one vehicle powered partially or completely by electricity, or powered by hydrogen, that is currently being sold in Canada?"
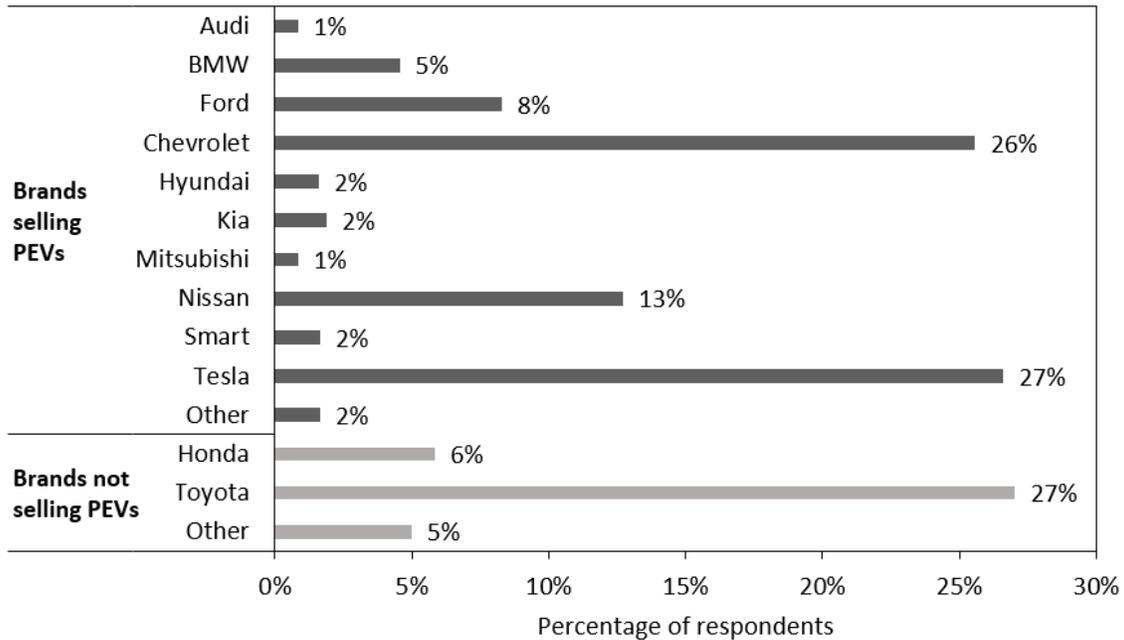

Figure 2. **Percentage of respondents mentioning various automaker brands when asked to name a make and model of PEV sold in Canada in early 2017 (n = 2,123, open-ended responses)**

Next, respondents were asked to indicate which brand (if any) most represents the "future of battery electric vehicles" and which brand (if any) they would be more likely to purchase a BEV from, both with closed-ended response categories. For the first question, 40% of respondents selected Tesla as representing the "future of BEVs" (Figure 3), which is more than quadruple the frequency selected for any other brand.

However, responses to the subsequent question about actual purchase were more evenly spread across different brands. For those respondents who identified Tesla as the brand representing the future, only 23% indicated they would purchase a Tesla.

As shown below, when asked which brand they would most likely purchase a BEV from, Toyota is selected most frequently (by 28% of respondents), followed by Honda (25%), and Tesla (23%).
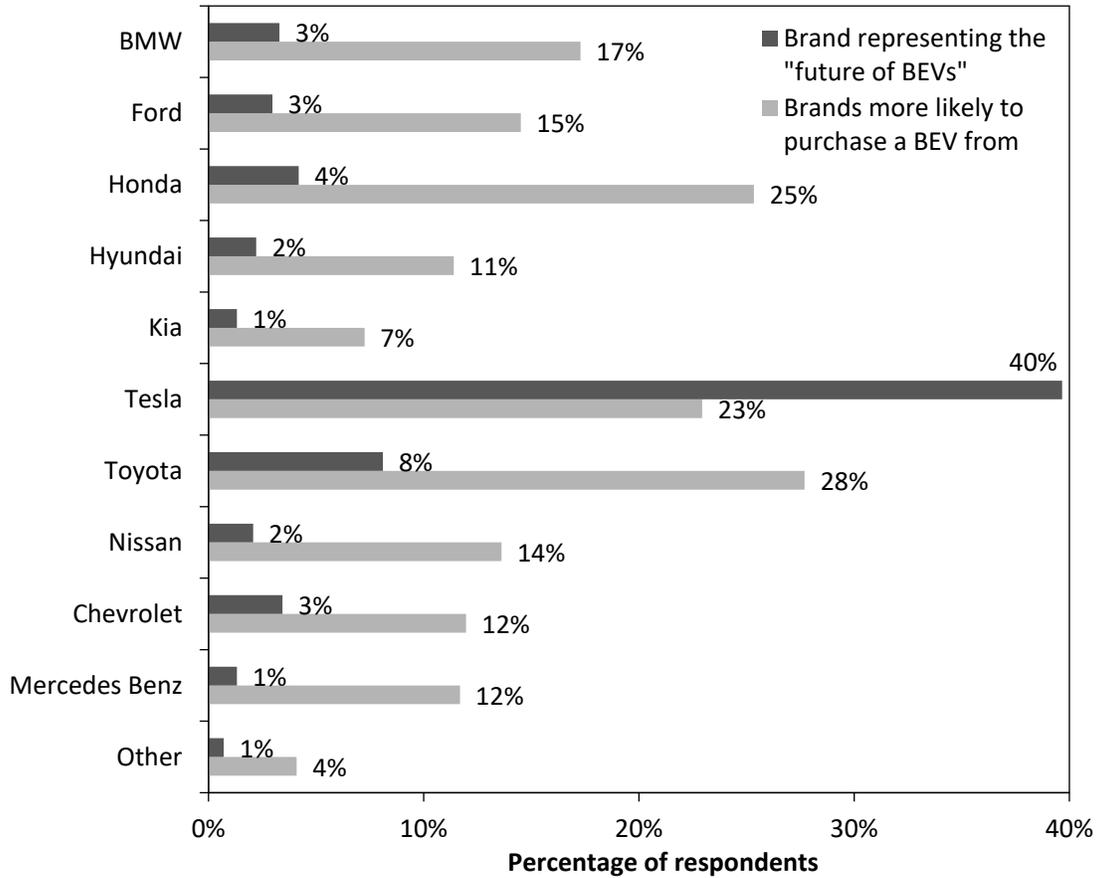
Figure 3.   Percentage of respondents that identify brands with being the "future of BEVs", vs. brands they would most likely purchase a BEV

3.3. Identifying brand loyal respondents (full sample, n = 2,123)

I further examine the entire sample to identify brands that respondents indicated they currently own and to compare that with the brands they would be most likely to purchase/lease a BEV. To investigate brand loyalty, I used the questions regarding the makes currently owned by respondents and which brands respondents would be more likely to purchase or lease a BEV. I recorded all of the primary brands that respondents indicated they owned, and then compared that list with the brands respondents said they would most likely purchase a BEV. I then explored the likelihood that they would most likely purchase a BEV from a brand that they currently owned. I generated percentages of respondents who currently owned a brand and indicated they would be more likely to

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purchase a BEV from the brand they currently owned. Those who currently owned a brand and demonstrated interest in purchasing from the same brand, I consider them to be brand loyal. In this analysis, as seen in Figure 4, Honda shows the highest level of brand loyalty, with 31% of current Honda brand owners indicating that they would most likely purchase/lease a BEV from Honda. Toyota is very close behind Honda, with 30% brand loyalty. Ford has 16% brand loyalty, and all the other brands have fairly low levels, in comparison.
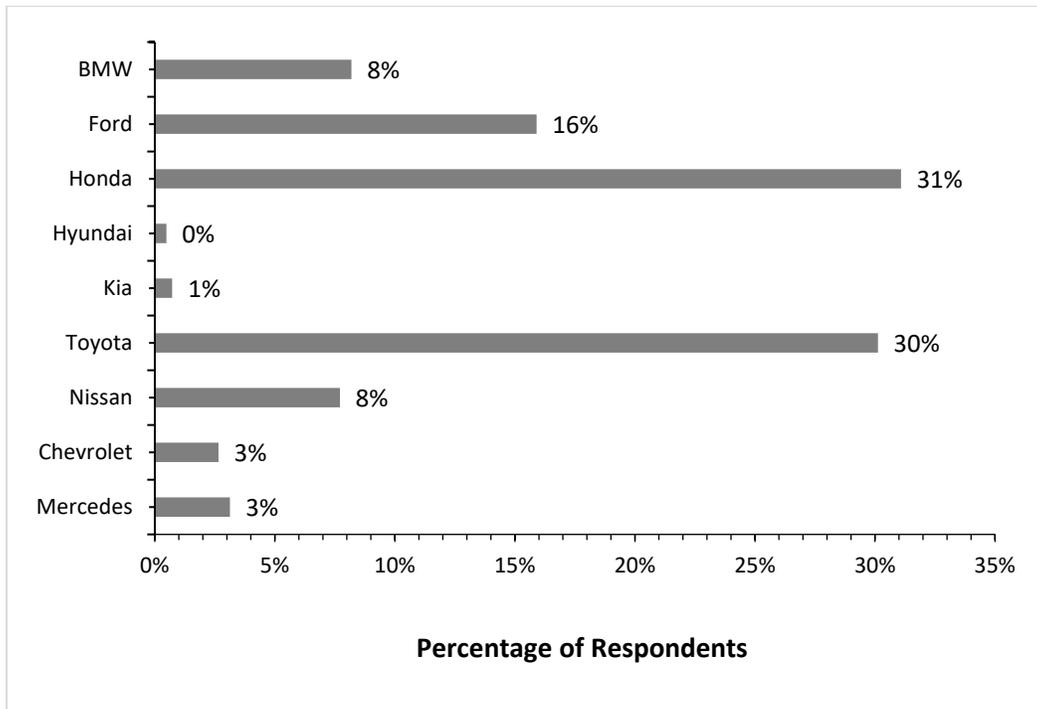
Figure 4. **Percentage of respondents who indicated that they would be most likely to purchase/lease a BEV from a brand that they currently owned**

3.4. Perceptions of Tesla ("Tesla-familiar" subsample, n = 1,500)

I now focus on the subsample of respondents (n = 1,500) who are at least "somewhat familiar" with Tesla. To begin, the survey asked these respondents how familiar they were with different aspects of Tesla, including Tesla vehicle models, as well as its CEO, Powerwall and patents (Figure 5). Interestingly, the greatest proportion of respondents (56%) are familiar with Tesla's CEO, which is higher than the proportion of

respondents familiar with any of Tesla's four vehicle models (35-52%). Some respondents are also familiar with Tesla's Powerwall (33%) and Tesla's release of patents (29%), demonstrating that respondents' knowledge of Tesla extends beyond their vehicles only.
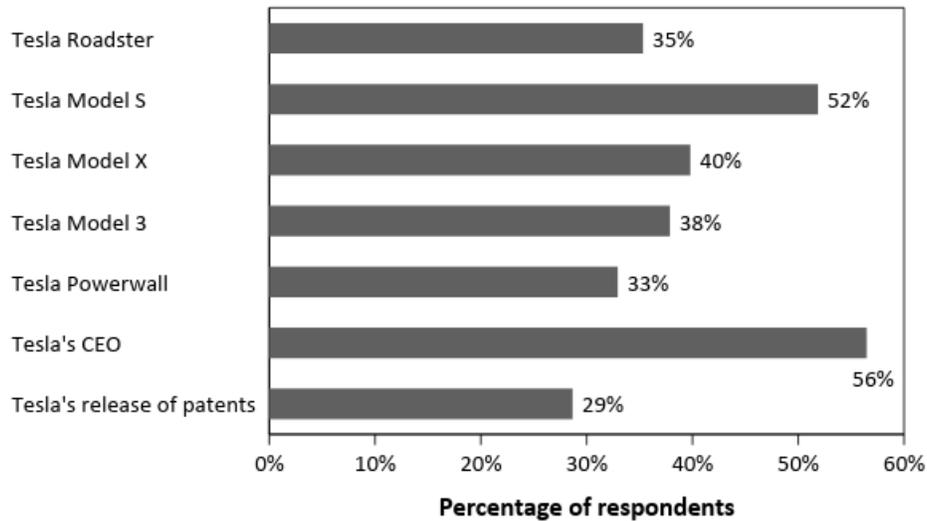

Figure 5.   Percentage of respondents who demonstrate familairity with different aspects of Tesla (n=1500)

Of the Tesla-familiar respondents, the survey asked if Tesla has increased their belief about various characteristics of BEVs. Figure 6 organizes these beliefs into functional, symbolic, and societal characteristics of BEVs, following the framework introduced in Section 1.2 (Axsen and Kurani, 2012). For each characteristic, between 23% and 68% agree that Tesla has influenced their perception of BEVs. Among the symbolic characteristics, most Tesla-familiar respondents agree that Tesla has increased their belief that BEVs are innovative technologies (68% of respondents), stylish (59%), and fun to drive (50%). Among the societal characteristics, most of these respondents agree that Tesla has increased their belief that BEVs can help to reduce national reliance on oil (67%) and can help to reduce climate change (63%) and air pollution (68%). Almost half of Tesla-familiar respondents indicate that Tesla has increased their beliefs about several functional characteristics of BEVs, namely their reliability (47%), cost-effectiveness (49%), and safety (48%). On the other hand, almost 50% of Tesla-familiar respondents disagree with the statement that Tesla has increased their belief that BEVs have "a reasonable purchase price."
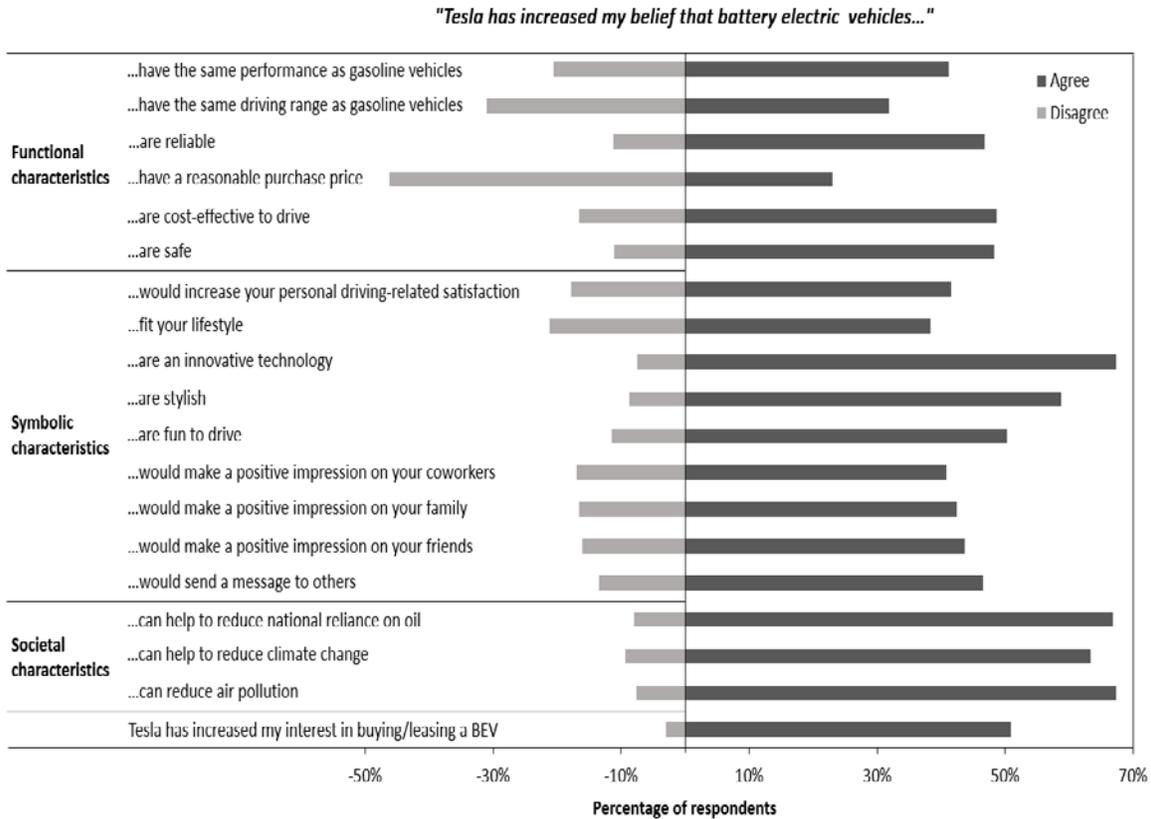
"Tesla has increased my belief that battery electric vehicles..."

Figure 6. **Percentage of respondents who agree or disagree with belief statements aboud Tesla's influence (n=1500)**

Tesla-familiar respondents were then asked to assess 22 different images, rating each based on the strength of association with BEVs in general, and with Tesla specifically. Figure 7 organizes these responses by functional, symbolic, and societal images categories. Across the sample, respondents are more likely to associate Tesla with each of 21 images (spanning all three categories), than for BEVs. This finding suggests that respondents' perceptions towards Tesla are stronger than their perceptions towards BEVs in general. Most of these images appear to be positive, including being "attractive", "high performance", "sporty", "stylish", and "successful". However, some are more negative by nature, such as being "expensive", "arrogant", and "hyped". Only the image of being "economical" is more likely to be associated with BEVs, overall, than with Tesla.

"I associate BEVs/Tesla with the image of being…"
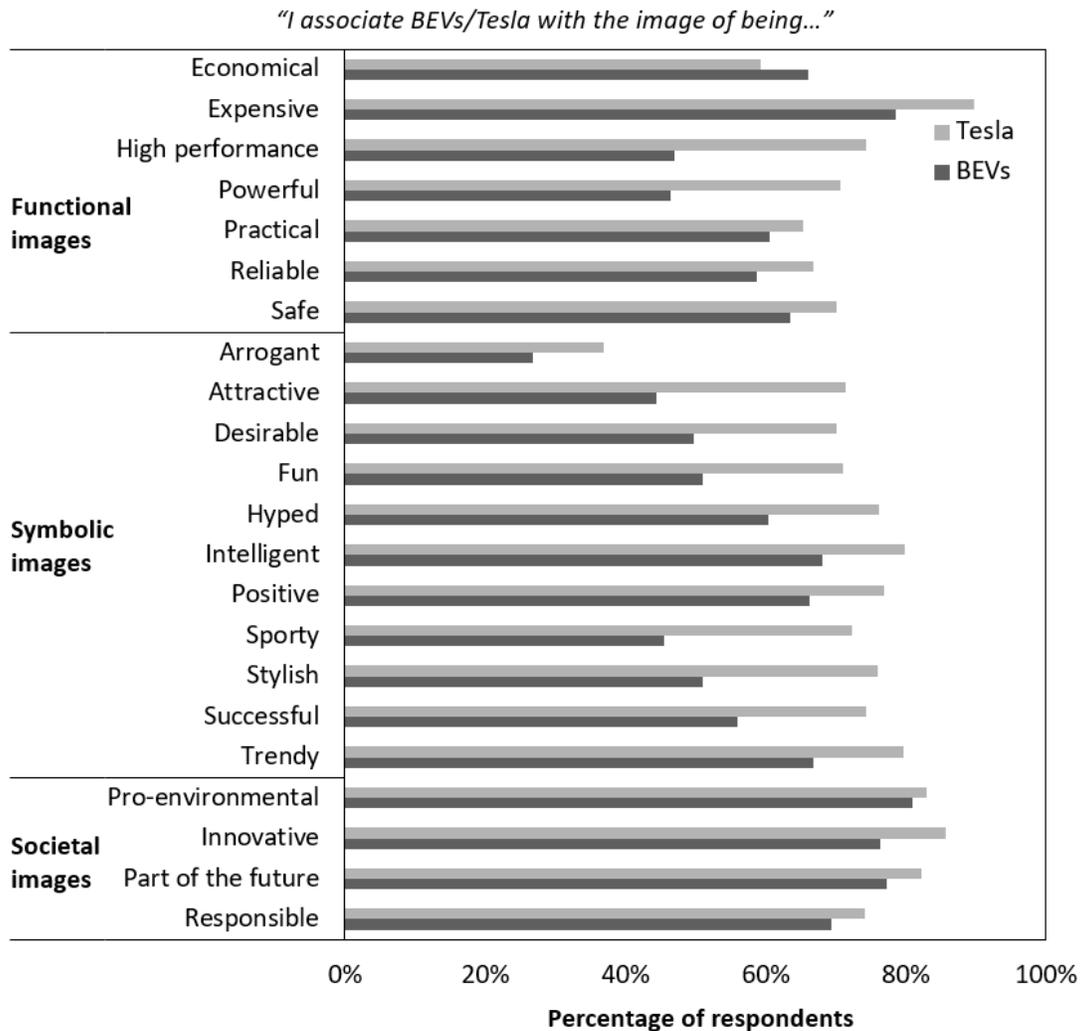
Figure 7. **Percentage of respondents demonstrating image associations with Tesla and with BEVs in general (n = 1,500)**

3.5. Interest in BEVs ("Tesla-familiar" subsample, n = 1,500)

Lastly, for the Tesla-familiar subsample, respondents were asked how Tesla was affecting their interest in purchasing/leasing a BEV. Figure 8 shows that 51% of respondents indicated that Tesla was increasing their interest in purchasing a BEV. Of this subsample, 46% indicated that Tesla had no effect on their interest in purchasing a BEV. Related to this finding, 3% of the sample reported that Tesla has decreased their interest in purchasing a BEV.

Figure 8. **Percentage of respondents that exhibit how Tesla is affecting interest in buying/leasing a BEV (n = 1,500)**

Chapter 4.

Discussion and Conclusion

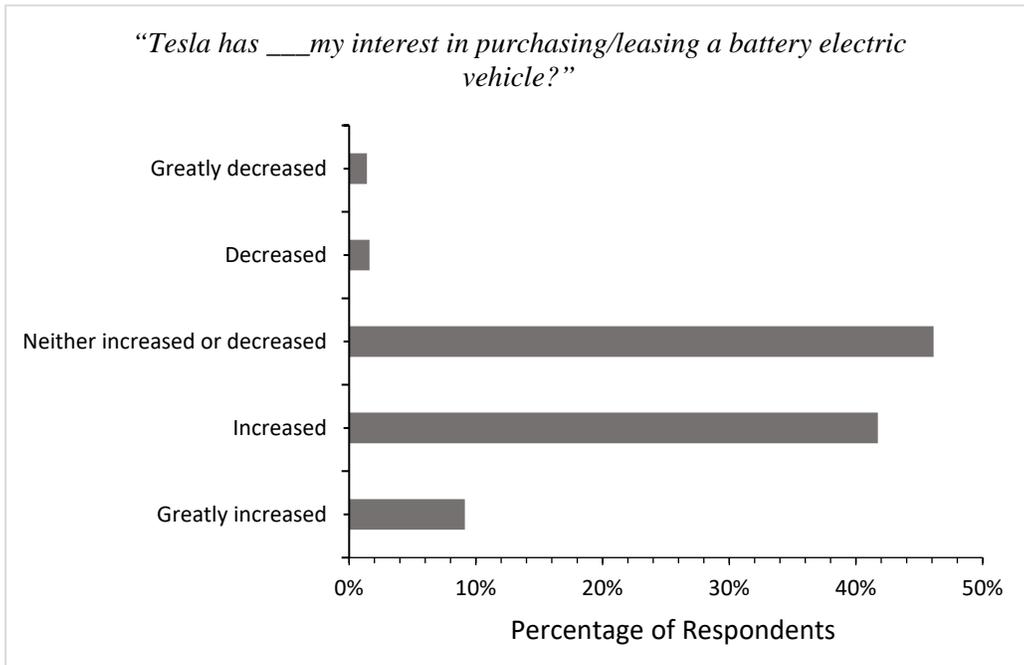Most PEV research has neglected the role of brand, especially the role of what could be particularly unique brands like Tesla. In this paper, I analyze data collected from a survey of 2,123 Canadian new vehicle-buying households to explore the extent to which consumers associate BEVs with specific brands, their brand loyalty, as well as their perceptions of Tesla specifically. In the following sections, I address the results from my analysis and expand on my findings, while identifying limitations and suggesting areas for future research.

Recall that concepts in the marketing literature may help to explain how particular automotive brands, such as Tesla, could be set apart from other automakers in the public consciousness. I chose to focus on conceptual frameworks such as brand equity, pioneer brand advantage, brand loyalty, brand awareness, and the halo effect.as I hypothesized that they might shed light on consumer perceptions of BEVs and brands. After reviewing these concepts, I then use the survey data to assess the degree to which consumers associate BEVs with particular vehicle brands, explore for evidence of pioneer brand advantage and/or brand loyalty, evaluate consumer awareness of Tesla in general, and with specific aspects of Tesla, to compare consumer perceptions of Tesla with perceptions of BEVs in general and identify if Tesla has increased interest in purchasing/leasing a BEV.

4.1. Findings

In my analysis, I find that some survey respondents associate BEVs with Tesla as a brand. When asked to freely associate PEVs with specific brands, Tesla is among the most commonly mentioned brands (equal only to Toyota). More respondents also perceive that Tesla represents the "future of BEVs" more than any other brand. These associations could be a sign of Tesla's pioneer brand advantage, where research finds that consumers have better recall and familiarity with pioneer brands (Alpert and Kamins, 1994; Alpert and Kamins).

However, Tesla is not necessarily the brand that respondents would be most likely to purchase a BEV from. A greater proportion of respondents would be more likely to purchase a BEV from Toyota or Honda (as well as other brands) compared to Tesla. This finding is particularly interesting as both Toyota and Honda did not sell PEVs in Canada at the time of the survey. This could be an indication of brand loyalty for some consumers, who prefer more mainstream automakers, or automakers with which they have previous experience. Research finds that consumers display a generally high degree of brand loyalty in their vehicle purchases, meaning they are more likely to purchase vehicles from brands they have already purchased (Moons and de Pelsmacker, 2015; Nayum and Klockner, 2014; Train and Winston, 2007). This could also represent some level of skepticism in the consumer consciousness, as respondents perceive Tesla as futuristic or innovative, but not as practical or economical.

Additionally, when brand loyalty was investigated, it was found that respondents who own Honda and Toyota specifically displayed more "brand loyalty" than respondents who owned other brands. This finding could indicate higher levels of brand loyalty to Honda and Toyota, which would mean that owning a Honda for example, might make a consumer more likely to indicate interest in making a future purchase from Honda.

Additionally, beliefs about a brand can be a powerful tool in influencing purchase decisions. It is possible that consumers who exhibit positive brand perceptions about Tesla – such as about Tesla being innovative, able to help reduce climate change and air pollution, and that the vehicles are safe and reliable – are exhibiting the halo effect. As discussed earlier, the halo effect is a cognitive bias (Tiffin and McCormick, 1965) that offers an explanation for why consumers might have impressions of an attribute, such as Tesla being innovative, and allow such to dominate their views. This could suggest that consumers have high levels of positive perceptions of Tesla but do not have very high levels of familiarity with Tesla itself. For example, a consumer may feel strongly about "knowing" that Tesla is reliable, safe, or able to help reduce climate change, without actually knowing any significant amount of information about any of the Tesla models. This halo effect for Tesla could be positive since Tesla is seen as increasing interest in buying/leasing a BEV among 50% of respondents. Branding can be leveraged against competitors, and the positive perceptions that consumers have of a brand could be used to influence purchase decisions. Therefore, the higher percentages of respondents who indicated positive images of Tesla could directly relate to interest in purchasing a Tesla.

Lastly, of those familiar with Tesla (about 70% of the sample), some indicate that Tesla is shaping their beliefs about BEVs. For example, Tesla-familiar respondents agree that Tesla has increased their perceptions of several symbolic dimensions of BEVs (e.g., that BEVs are "innovative," "stylish," and "fun to drive") as well as several societal dimensions (e.g., that BEVs can help to reduce climate change and air pollution). Most respondents also tend to associate Tesla more strongly with positive images, than they do with BEVs more generally. For example, Tesla-familiar respondents more strongly associate Tesla with "attractive," "high performance," "sporty," "stylish," and "trendy" images than with BEVs. This observation could suggest a halo effect around Tesla, where respondents rate a variety of aspects of Tesla more positively or strongly due to their perceptions of Tesla as a brand. Related to this finding, 51% of respondents indicated that Tesla was increasing their interest in purchasing/leasing a BEV.

The results of my findings indicate that Tesla is shaping consumer perceptions. These results are applicable to policy makers as it could assist with understanding BEV perceptions that consumers may have. By understanding BEV perceptions, policy makers could possibly alter existing policies or provide new ones that would lead to increased adoptions of BEVs. Newly released details on CleanBC indicate that ZEV sales will increase to 10% by 2025, 30% by 2030 and 100% by 2040. This increase in ZEV sales will mean major increases in purchases of BEVs. Therefore, I feel it would be imperative to have an understanding of how consumers perceive the brands selling these vehicles. Although this analysis is only meant to be explore consumers' association between brand and BEVs, research efforts should continue to examine the role of brand in relation to BEV interest and preferences, given its importance to vehicle purchase behaviour.

4.2. Limitations and future research

This study includes several notable limitations that future research should address. Statistical analysis is able to assist in describing, showing and summarizing data. However, it is limited, and does not allow for me to make any conclusions beyond what I can show and infer. A more comprehensive investigation and analysis conducted on the data would provide a wealth of insight into specific perceptions that consumers might have towards Tesla and BEVs in general.

Additionally, a more in-depth analysis would be beneficial to explore and further understand the purchase decisions of consumers regarding BEVs. Furthermore, I only explore a limited set of perceptions of BEVs and provide limited analysis based on frequencies and percentages. Future work would benefit from examining a wider set of perceptions of BEVs and brands. Future work could also perhaps investigate other theories and frameworks of consumer behaviour. Considering that other BEV consumer studies ignore investigations of brand, future research should delve into how the positive perceptions that consumers have for brands such as Tesla may spill over into positive perceptions towards BEVs, in general. This could perhaps also be stretched into analyzing whether positive perceptions of a brand such as Tesla, causes any increase in positive perceptions towards other forms of alternative fuel vehicles. This information could prove useful in the development of policies targeted at increasing the uptake of alternative fuel vehicles.

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