Performance Expectations of Branded Autonomous Vehicles:

Measuring Brand Trust Using Pathfinder Associative Networks

by

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ABSTRACT

Future autonomous vehicle systems will be diverse in design and functionality since they will be produced by different brands. In the automotive industry, trustworthiness of a vehicle is closely tied to its perceived safety. Trust involves dependence on another agent in an uncertain situation. Perceptions of system safety, trustworthiness, and performance are important because they guide people's behavior towards automation. Specifically, these perceptions impact how reliant people believe they can be on the system to do a certain task. Over or under reliance can be a concern for safety because they involve the person allocating tasks between themselves and the system in inappropriate ways. If a person trusts a brand they may also believe the brand's technology will keep them safe. The present study measured brand trust associations and performance expectations for safety between twelve different automobile brands using an online survey.

The literature and results of the present study suggest perceived trustworthiness for safety of the automation and the brand of the automation, could together impact trust. Results revelated that brands closely related to the trust-based attributes, Confidence, Secure, Integrity, and Trustworthiness were expected to produce autonomous vehicle technology that performs in a safer way. While, brands more related to the trust-based attributes Harmful, Deceptive, Underhanded, Suspicious, Beware, and Familiar were expected to produce autonomous vehicle technology that performs in a less safe way.

These findings contribute to both the fields of Human Automation Interaction and Consumer Psychology. Typically, brands and automation are discussed separately however, this work suggests an important relationship may exist. A deeper understanding

of brand trust as it relates to autonomous vehicles can help producers understand potential for over or under reliance and create safer systems that help users calibrate trust appropriately. Considering the impact on safety, more research should be conducted to explore brand trust and expectations for performance between various brands.

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INTRODUCTION

Rapid technological innovation introduces great uncertainty in how people should interact with technology (Van Geenhuizen & Nijkamp, 2003). It is often difficult to predict how new systems will perform, therefore, people often do not interact appropriately with technology and this can impact safety Trust in automation is important because it influences how much people accept and rely on the automation, it influences people's behavior toward a system (Lee & Moray 1992). However, with autonomous vehicles, the automation is also tied to a brand name. Autonomous vehicle technology is becoming increasingly complex and difficult to understand and although there is a lot left to learn, we still see these systems begin to populate the media and our roadways. Advanced autonomous vehicle technology is becoming more variable than existing automobile technology, such as, automatic gear shifting and traditional cruise control settings. These older features may also be presented with different interfaces across brands, however, they function similarly. Especially, in the developmental stages of more advanced features, we begin to see different interfaces and different functionality.

Consider a pedestrian waiting to cross a street; will a fully autonomous vehicle stop for them? How will the vehicle communicate to the pedestrian that they may cross? What will the pedestrian expect the car to do?

The answers may depend on the brand of the vehicle, and a person's perceptions of the branded vehicle's capabilities. One brand of vehicle might always stop, whereas another might only stop if the pedestrian is a specific distance from the curb. Many technology corporations and automobile manufacturers are developing autonomous vehicles. The sheer variety of companies with different technologies and design approaches is likely to yield great diversity. Separate corporations have a common goal to design, produce, and sell vehicles with autonomous technology. However, to differentiate vehicles in such a competitive market, systems consist of various features and programming that represent the different brands they are associated with, including, the brand's personality, identity, target consumer groups, and other products and services they have on the market. The most salient difference is often between interfaces, what the system looks and feels like. However, sometimes the underlying functionality of similar feature may actually differ between brands of autonomous vehicles as well. In short, different brands produce different experiences. It is possible these brand differences yield different levels of trust in the automation, therefore different expectations for vehicle performance.

In fact, this situation exists already. Park-Assist (BMW) and Autopark (Tesla) are both autonomous parking features, however, their Human-Machine Interfaces (HMI) are different and require different inputs from the person using the feature. For instance, Tesla employs a streamlined process; about three actions are required to parallel park the vehicle using Autopark. The experience with BMW, however, is more cognitively involved. The driver must initiate the Park-Assist feature, press the brake, turn on their blinker, read a pop-up message stating they understand that they are liable for the vehicle's ultimate performance, confirm this by pressing OK, then they must press and hold the Park Assist button for the duration of the entire parking process, and release the brake when the process is complete.

Safety guidelines and standard requirements do not remedy these inconsistencies. The U.S. Department of Transportation and the National Highway Traffic Safety Administration (NHTSA) provide guidelines in *Automated Driving Systems 2.0: A Vision for Safety (September 2017)*. However, these standards still allow producers great freedom in implementation. For example, one guideline states: “HMI design should also consider the need to communicate information regarding the Automated Driving System’s state of operation relevant to the various interactions it may encounter and how this information should be communicated” (pg. 10). Just as a rubric for an academic assignment does not lead students to submit identical projects, the NHTSA guidelines address broad safety concerns and leave room for variety in system designs and configurations.

When considering autonomous vehicles, the technical capabilities of the automation and brand associations may both contribute to expectations and trust for the system. The follow review of the literature considers the potential influence of branding on user perceptions of – and expectations for – the safety of autonomous vehicles. relates principles of Cognitive and Social Psychology, Marketing, Consumer Psychology, and Human-Automation Interaction, identifies the gaps within the research, and seeks to explore relationships between brand trust and trust in automation.

CHAPTER 2

LITERATURE REVIEW

A literature search was conducted using various databases including Google Scholar, PsycINFO and Academic Search Premiere via the ASU Library Catalog. Searches included varying combinations of key words including, “trust”, “brand trust”, “brand personality”, “branding”, “associations”, “automation”, “automation bias”, “autonomy”, “autonomous vehicles”, “HAI”, “trustworthiness” and “safety”.

Articles for this review were selected from various journals in the areas of Marketing Research, Social Psychology, Consumer Psychology, Human Factors, and Human-Automation Interaction. Federal and public sources provided by NHTSA were also referenced. Many brand-related articles report findings of brand trust, brand affect and brand loyalty related to predicting purchasing behavior. However, studies and articles that primarily focused on branding and price or purchasing decisions we excluded from the review. Additionally, many of the articles related to trust in automation focused on measuring trust in the moment or after interacting with a system. In the literature, less focus tended to be placed on prospective trust, or trust expectations, prior to observing or experiencing the system’s performance. Though, there are many factors that are reported to influence trust. This review focuses primarily on automation and autonomous vehicles. Therefore, articles related to trust, expectations and safety judgements of automation as it may relate to an associated brand are found in this review. Since this is a broad topic, a large number of articles were scanned, and 38 sources are referred to in this review. Broad ideas include cognitive biases, brands, trust in automation, automation bias, brand trust, self-congruity and risk judgements.

Trust in Automation

Trust in automation is the belief that another agent will help in uncertain, or vulnerable, situations (Lee & See, 2004). Trust is often goal oriented. For autonomous vehicle systems, a primary goal is to travel from point A to point B in a safe, efficient, and pleasant way. Trust is based on the expectation that when given control, the system is capable of performing, and even improving, the driving task while most importantly, keeping the passengers safe. Trust depends on how successful the person expects the automation to be (Lee & Moray 1992; Sheridan 1992; Lee & See 2004). This expectation guides a person's behavior with a system (Mosier, Skitka, & Heers, 1998; Lee & See, 2004).

The amount of trust a person has in a system should reflect the system's capabilities, especially when monitoring and occasional intervention are required. For example, when a driver must switch between an Autopilot feature and manual control. Otherwise, when trust is not appropriately calibrated, human-automation systems often break down (Lee & See, 2004). When a system breaks down it is not working as intended, this typically suggests poor performance can potentially cause harm.

Various design characteristics affect expectations and trust in autonomous systems (Lee & See, 2004). Choi and Ji (2015) explored factors that influence trust in autonomous vehicles specifically. The goal of this study was to explore factors that influence trust in automation, and how a person's level of trust in the system can predict the likelihood they will adopt and accept autonomous vehicles. They surveyed 552 drivers and discovered three constructs to positively impact trust. These factors included, *system transparency, technical competence,* and *situation management.* They found trust perceptions tend to increase for highly transparent systems, more technically competent systems, and systems with acceptable situation management (Choi & Ji, 2015). They also found increased trust in the system led to decreased perceived risk. Increased trust was also shown to increase the likelihood that the person would adopt and accept autonomous vehicles.

These factors are closely tied to system reliability, which is the degree to which the automation does what it is intended to do. Previously, most work involving human-automation interaction did not focus on dynamic, real-world environments. However, Desai et al. (2012) conducted a study to mimic real-world, unstructured situations in which autonomy reliability is not as stable. This study explored the effects of fluctuating reliability on trust in automation and use of its capabilities. Decreases in system reliability were shown to decrease trust (Desai et al., 2012). Results also indicated that increased trust in automation was linked to low perceived risk and low cognitive load (Desai et al., 2012). This supports the idea that system designs should address situational characteristics such as, perceived risks, workload, and task difficulty. These factors and trust seem to mutually reinforce one another. However, expectations for system functionality, true system capability, and the person's role are often mismatched.

An example of this is Automation Bias; when a person favors the use of automation over their own input. This often results from an over trusting attitude and leads to an inappropriate level of reliance on the system (Mosier, Skitka, & Heers, 1998). Other instances resulting from inappropriate calibrations of trust include *Misuse, Disuse and Abuse* (Parasuraman & Riley, 1997). In 1997, Parasuraman and Riley synthesized theoretical, empirical, and analytical work regarding human *use, misuse, disuse,* and *abuse* of automation technology. They defined each of these instances and claimed that a deeper understanding of these use cases will inspire improvements in system design, training, and policies regarding the use of automation.

Over and Under Reliance

When a person thinks the system is capable of things that it actually is not capable of, they tend to over-trust the system. It often results in misuse of, or over reliance on, the system (Parasuraman & Riley, 1997). This trust-based behavior can compromise safety. For example, consider Tesla's Autopilot feature. People who think they can be less involved in the driving task are misusing the system. Based on the vehicle's true capabilities, drivers are still required to be vigilant, to supervise the vehicle in the driving task. People who have the impression that they can watch videos or send text messages instead of monitoring the vehicle, are over-relying on the system. These individuals are under the impression that the system is capable of things that it actually is not capable of. Therefore, they may over-trust the system, and allocate tasks to the system that are more complex than it is able to handle. In our Autopilot example, the person may give up all control and depend entirely on the automation to drive down a road while they text on their phone. In the event that the vehicle comes across an obstacle or situation it doesn't recognize. This could lead to poor performance ranging from a near crash to even a fatal accident.

Contrastingly, low levels of trust can promote disuse, which is under-reliance on the system (Parasuraman & Riley, 1997). A driver who refuses to use any autonomous features in a vehicle is under-relying on the system. This may occur because the person doubts the vehicle's technological capabilities, or they believe they are better. This is can also be a safety concern because human drivers do not always perform well. There may be times where the automation is safer and performs better than a human could. For example, an automated braking feature may detect an obstacle in a blind spot and stop the vehicle just before impact. Autonomous features in vehicles are intended to improve driver and vehicle performance and safety. They may not be perfect, but they are intended to promote safer and more efficient driving than a human driver alone (Beiker, 2012).

Traditionally, in the literature, it is often the case that autonomous vehicles and various types of advanced technology are discussed in isolation – without regard to environmental factors. But ultimately, people don't actually experience or interact with technology in that way. Instead, we have a ton of real-world information, like a brand for example, that may affect our perceptions.

Brands

A brand is a name, term, or symbol that distinguishes a seller's product or service from others (Bennett, 1995). An important part of branding entails the accumulation of associations and perceptions, in memory linked to a brand (Aaker, 1991). In essence, it includes what consumers know (or believe) about products. Branding and associations affect people's behaviors and interactions with products and services (Rossiter & Percy, 1991).

According to Deighton (1992), brands "promise a future performance". They set expectations for the quality of their product (Keller, 1993). Trust in the brand is established through fulfillment of these expectations over time (Delgado-Ballester, 2003). From the moment the brand is born, it is associated with specific values, limitations, and target consumer groups (Kotler & Andreasen, 1991). Brands are also closely linked to the performance and quality of their products and services (Keller, 1993; Zeithaml 1988), specifically, how reliable and successful the product is at fulfilling its intended purpose. In relation to a brand, reliability and trustworthiness perceptions are an individual's belief a specific brand will perform in a particular, or positive, way.

Additionally, people tend to spontaneously ascribe human personality characteristics to brands, creating a brand personality that summarizes brand associations. To categorize these personalities, Jennifer Aaker (1997) developed an empirically derived framework (*figure 1*) of five dimensions of brand personality, and 15 associated facets, shown below. These dimensions, *Sincerity, Excitement, Competence, Sophistication, and Ruggedness* are useful for describing and summarizing brand associations.

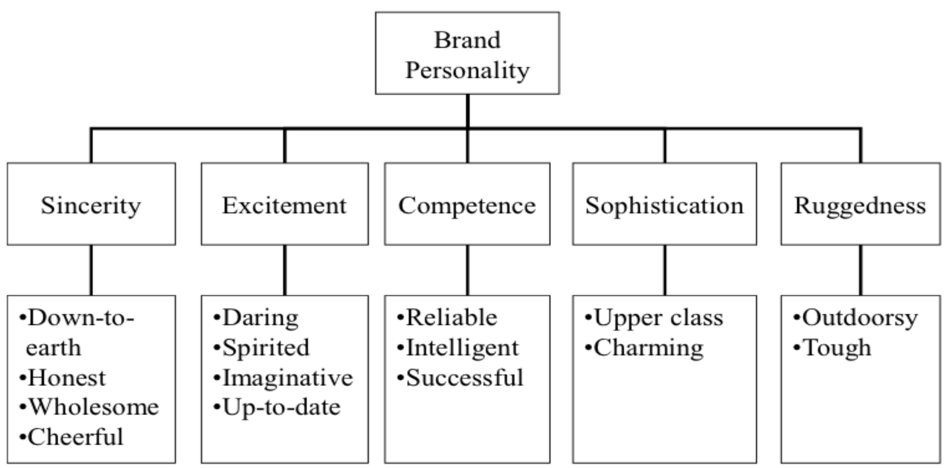

Figure 1: Brand Personality Framework (Aaker, 1997)

This brand personality framework was based on Malhotra's (1981) work with construct scales. Originally, Aaker started with a list of 309 traits. She reduced this by more than half and then told participants to rate 37 brands on these traits. After numerous trials, and a factor analysis – five dimensions of brand personality emerged; including, sincerity, excitement, competence, sophistication, and ruggedness. From these dimensions, she identified and defined 15 associated facets. Each facet adds detail to one of the five dimensions and describes it by providing context. For example, the competence dimension is supported by three facets (reliable, intelligent, successful).

These brand personality dimensions are useful for describing and summarizing brand associations. For example, it might be appropriate for a good brand of autonomous vehicle to be closely associated with a competent brand personality. Since competence and reliability are closely tied to trustworthiness (Wojiciszke & Abele, 2008; McCroskey & Teven, 1999; Fiske, Cuddy & Glick, 2007); which translates to safety and the ability to perform in the automotive industry.

Additionally, the dimensions and facets are also useful for differentiating brands from one another (Freeling & Forbs, 2005). Brand exposure often evokes strong, automatic, and subconscious inclinations and feelings about a product (Thomson et al., 2005). Considering the pedestrian example, one brand of autonomous vehicle may be designed to stop for the pedestrian to cross in a way that ensures the pedestrian that it is okay to do so, while another may not. The brand personalities of each may help the pedestrian decide to walk or not. In any interaction with autonomous vehicles, a person may simply base their trust in the system on associations. They may take specific actions surrounding an autonomous vehicle based on its brand personality.

Brand Trust and Automation

Trust is a fundamental component of good relationships; it evolves based on past experience (Rempel et al., 1985; Rotter, 1980). Interpersonal trust commonly discussed in the literature as how much one is willing to accept vulnerability, or risk. It is determined by a perception of the world and the likelihood that others, or the environment, would harm the self (Rotter, 1980, Robinson, Shaver, & Wrightsman, 1991). Regardless of individual differences in interpersonal trust, or willingness to trust others, people identify patterns in intentions, behaviors, motivations, and qualities linked to a positive outcome (Rotter, 1980; Rempel et al., 1985). Trust is not dichotomous. It is not simply a matter of trust or distrust, instead, levels of trust fall along a continuum.

Brand trust is the level of security associated with a brand. It is based on the perceived reliability of the brand, and how responsible it is for the welfare of the consumer (Delgado-Ballester, 2003). Brand trust is also context dependent. It is specific to the nature of the situation and the other agents involved (Mayer et al., 1995; Schaefer et al., 2016). Trust-based relationships between consumers and brands, resemble that of humans and automation. Similarly, human-automation trust is based on expectations of system capabilities.

History-based trust focuses on past performance (Merritt & Ilgen, 2008), and how it relates to future interactions. Brands form relationships with consumers by meeting, or exceeding, their expectations. In this way, brands build trust by being predictable (Mayer et al., 1995), providing good experiences time after time.

Automation is designed to build trust in the same way. A trustworthy system is simple and understandable. It acts in the operator's best interest, is designed to induce proper trust calibration, shows performance history and meets the operator's performance expectations (Lee & See, 2004). Autonomous vehicle systems produced by different brands will vary in these characteristics.

For instance, Carlson et al. (2013) demonstrated that trust in a vehicle's capabilities was higher for autonomous vehicles created by a well-known brand than for an unknown brand. This work identified factors that influence trust in branded autonomy, such as, *statistics of past performance*, *extent of research on the car's reliability*, *predictability*, *credibility of the engineers*, *technical capabilities, and possibility for system failure.*

Carlson et al. (2013) examined factors that influence trust in two domains; autonomous vehicles and medical diagnosis systems, and within two dimensions; safety criticality and brand recognizably. In this study, participants ranked 29 factors based on their influence on trust. In the autonomous vehicle domain, *statistics of the car's past performance* ranked the highest. The *extent of research on the car's reliability* and *credibility of the engineers who designed the car* were also ranked within the top six factors.

Therefore, it is not surprising that there was a significant difference between trust in systems produced by a well-known company and systems produced by an unknown brand, or small start-up company (Carlson et al., 2013). Results indicated that participants trusted the vehicles capabilities more when it was created by a well-known brand, Google. Participants rated the statements: "I trust the machines' capabilities because it was created by Google", and, "My trust in a fully-autonomous system similar to this machine would decrease if it was created by a lesser- known company." These findings were reinforced between different groups that were asked the questions in the opposite direction. Higher trust in the capabilities of technology created by well-known companies than a lesser known company was shown in both domains (autonomous vehicles and medical diagnosis systems), in both safety-critical and non-safety-critical situations Carlson et al. (2013).

Results demonstrated that brand associations influence trust in autonomous technology. In this study*, past performance, reliability, predictability, technical capabilities,* and *credibility of the engineers* emerged as top influential factors for trust (Carlson et al., 2013). These are similar to the factors proposed by Lee and See (2004) that include, *performance*, *process*, and *purpose*. Where performance is how well the automation completes the task, *process* is a person's experience with the system and their opinion for how it works, and *purpose* is the system's intention. A deeper understanding of the similarities and differences of these two models of trust, in automation and in brands, can how they influence trust in human-autonomous vehicle can help produce safer and more desirable systems. These insights can inform autonomous vehicle producers design decisions. For instance, if it is known that people tend to think a certain brand of vehicle will be more safe, or more capable of controlling a vehicle on the road, then designers and marketers can present the automation in a way that promotes appropriate trust calibration, and prevents over or under reliant behavior.

Brand is an element of autonomous systems that is often excluded in the exploration of trust in the realm of human-automation interaction. As mentioned above, trust in autonomous vehicles was shown to be higher for well-known brands than lesser known brands (Carlson et al, 2013), however it would be valuable to know if, and how, trust in automation varies between various well-known brands.

Measuring Trust in Automation

Generally, trust in automation is largely dependent on performance expectations; how successful the person expects the automation to be (Lee & Moray 1992; Sheridan, 1992; Lee & See 2004). Trust in automation has been characterized and measured across numerous domains. For example, Singh, Molloy, and Parasuraman (1993) used factor analysis to develop a Complacency-Potential Rating scale that measures automation induced complacent behaviors. Much like Automation Bias, discussed above, complacency is when a person is overconfident in the system, it tends to be associated with over reliant behaviors. Complacency-potential was shown to vary depending on a person's trust and confidence in the automation, in addition to their ultimate reliance on automation. Singh, Molloy, and Parasuraman (1993) demonstrated that complacency-potential can be measured using ratings that capture general attitude towards items related to everyday automation technology.

In proposing a quantitative model of trust, Sheridan (1988) also suggested seven attributes of trust for which systems vary. These included, *reliability, robustness, familiarity, understandability, explication of intention, usefulness* and *dependence*.

Additionally, Jian, Bisantz, and Drury (2000) developed an empirically derived scale to measure trust in automation. Using a series of experimental phases, they compared words relating to trust across three types of trust-based relationships; trust between people, trust between people and automation, and trust in general. Experimental phases included a word elicitation phase, a questionnaire phase, and a paired comparison phase. A cluster analysis was used to identify twelve factors, or attributes, related to trust between people and automation. Their results also suggested that trust and distrust are opposites, not separate concepts. Therefore, these attributes include words related to both trust and distrust. The twelve attributes were *Deceptive, Underhanded, Suspicious, Beware, Harmful, Confidence, Security, Integrity, Dependable, Reliable, Trustworthy*, and *Familiarity*. Further, Jian, Bisantz, and Drury (2000) used these twelve factors to develop a scale to measure a participant's trust in an autonomous system. The scale consists of twelve statements, such as, "The system is deceptive", and participants are instructed to rate each statement using a 7-point scale with 1 representing, "Not at All" and 7, "Extremely". Essentially, the scale is a series of Likert-style questions that measure how similar the participants impression of the system is to the statement.

Pathfinder

A Pathfinder algorithm (Schvaneveldt et al., 1989; Schvaneveldt, 1990) is a quantitative tool that can be used with pairwise relatedness data to create network models that illustrate associations, or similarities (Branaghan & Hildebrand, 2011). Pairwise relatedness data provides insight for how each of the comparison items are interrelated. It can be collected with multiple pairwise comparison tasks. For instance, to compare a list of many items, one could ask participants to consider two items at a time and rate their relatedness, or similarity, on a scale. Participants would do this until each item on the list has been compared against all others, so that every possible paired combination is rated. Given this type of data a pathfinder algorithm is used to link more related items visually using a node. The resulting network structure is a visual depiction of the perceived relatedness between the comparison items. The organization and structure of the network is outlined by nodes that link each of the comparison items together. The distance, or number of nodes, between comparison items in the network represents their relatedness.

In the network structure, highly related items are directly connected by a single node. For less related items, however, one or more links may be present between the comparison items. For example, if concept A and concept C are very related then a single node would connect them. Similarly, if concept C and concept B are very related then a single node would also connect them to one another. If concept A and concept B are less related, they would only be connected through their relationship to concept C, so two nodes would stand between them (see figure 2 below).

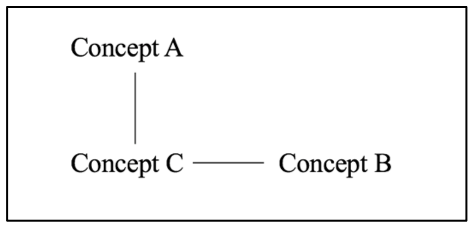

Figure 2: Pathfinder Network Example

Nodes within a pathfinder networks can also be quantified with weighted values. Higher weight values indicate that items are more related, lower weight values indicate items are less related.

Branaghan and Hildebrand (2011) used a Pathfinder algorithm to create visual networks for the relationship between a participant's self-image and certain brands. In their study, a pairwise comparison task was used to collect relatedness data between brand personality and automobiles. Participants also compared their self-image with the 15 dimensions and facets of Aaker's Brand Personality Framework (1997). They also compared 12 automobiles in this way. The pathfinder algorithm measured the match between each item compared to the others. The distance between the items represented their relatedness, these values were used to create association networks. These relationships were represented using associative networks because: "brand personality and self-image are knowledge structures, and facets of brand personality also describe the self" (Branaghan & Hildebrand, 2011, p. 304). Not only did the resulting networks illustrate congruity between the self and brand personalities, but also illustrated associations between the other brands included in the study. Branaghan and Hildebrand (2011) also demonstrated that brand personality associations are related to brand preferences.

The Present Study

The aim of the present study was to investigate the relationship between brand trust associations and performance expectations for safety of autonomous vehicles produced by various brands.

Previous work has shown trust in autonomous vehicles produced by well-known brands was higher than trust in autonomous vehicles produced by a lesser-known brand (Carlson et al., 2013). The present study however, explores trust across various well-known brands. Because increased trust in automation is linked to low perceived risk (Desai et al., 2012), it was hypothesized that brands more closely related to trustworthy attributes will be ranked as more safe. Therefore, brand trust associations would be positively correlated with performance expectations for safety. Such that, the closer a brand is associated with trust (opposed to distrust) the better a person would expect an autonomous vehicle produced by that brand to perform. Additionally, the further a brand is associated with distrust (opposed to trust) the worse a person would expect an autonomous vehicle produced by that brand to perform. Meaning, on average participants would predict better performance for safety for the brands more associated with trustworthiness, and worse performance for safety for the brands less associated with trustworthiness.

CHAPTER 3

METHOD

Participants

Participants were recruited online using the Amazon Mechanical Turk (www.mturk.com) crowdsourcing tool for survey data collection. All participants were compensated $1.00US for their participation, upon full completion of the survey. This amount was used on Amazon Mechanical Turk because it encouraged participation in the online survey without impacting the participants financial situation. One hundred and three participants were recruited for this study. This sample size was based on the sample size used in previous studies (Jian, Bisantz, & Drury, 2000; Carlson et al., 2013). Of the one hundred and three participants, the data from four participants was eliminated because it was deemed inaccurate. Inaccurate data was defined as a survey completed in 3 minutes or less, as this would be too fast to accurately read through each survey question. Additionally, inaccurate data also included surveys containing contradicting or incomplete responses.

This study included Mechanical Turk users with worker accounts who had participated in at least previous 50 tasks and maintained a 95% or above Human Intelligence Task (HIT) approval rating; this was done to encourage reliable data collection (Paolacci & Chandler, 2014). Since materials were presented in the English language, participants also had Amazon Turk worker accounts with a registered location within the United States.

At the end of the survey, participants completed a demographics questionnaire (Appendix E). Of the 99 participants, 61 were male, 36 were female, 1 identified as other, and 1 chose not to provide this information. All participants in this study were ages 18 and older. 50 of the 99 participants were between the ages of 18 and 34, 43 were between the ages of 35 and 64, 5 were 65 years old or older and 1 chose not to provide this information. Educational backgrounds varied, but all participants had at least a High School diploma and the majority of participants (60 of 99) completed an Associates, Bachelor's, or Master's degree.

Additionally, 91 were licensed drivers and 85 owned their own vehicle. This sample of 85 participants consisted of 13 Toyota owners, 12 Honda owners, 10 Ford owners, 7 Nissan owners, 5 BMW owners, 5 Chevrolet owners, 5 Mazda owners, 2 Volvo owners, and 26 other owners (brands included, Hyundai, KIA, Saturn, Mitsubishi, Dodge, Saturn, Jeep, Infinity, Audi, Range Rover, Mercury, Lexus, Cadillac, GMC, Subaru, and Suzuki).

Study Design and Materials

The present exploratory research study intended to investigate the relationship between two variables, brand-trust associations and performance expectations for branded autonomous vehicles. Brand-trust associations are characteristics or attributes related to trustworthiness, linked to a specific brand. Performance expectations are the predicted outcomes of branded autonomous vehicles when executing an action.

In order to measure these two variables, a two-part survey was used. All participants responded to the online survey using Qualtrics, which they accessed through their Amazon Worker account. One part of the survey included a ranking activity, the other included Likert-style rating questions.

The twelve automobile brands selected for this survey included, *Volvo, Mercedes, Volkswagen, BMW, Toyota, Honda, Nissan, Mazda, Ford, Chevy, Chrysler,* and *Tesla*. The twelve brands vary in their target consumer groups and average vehicle price. Generally, European, American, and Japanese brands were equally represented. Additionally, brands owned by the same corporation were not included (e.g., since Chrysler was included, Jeep was not).

The twelve trust-based attributes included in this study were, *Deceptive, Underhanded, Suspicious, Beware, Harmful, Confidence, Feeling secure, Integrity, Dependable, Reliable, Trustworthy*, and *Familiarity*. These attributes were selected and adapted from the empirically developed and validated scale for trust in autonomous systems (Jian, Bisantz, & Drury, 2000).

Procedure

Participants volunteered to participate in the study online by selecting the survey from their list of open surveys on their Amazon Mechanical Turk Worker's Account. On average it took participants 23 minutes to complete the survey.

First, participants read a brief description of this survey, including time commitment and monetary compensation amount, and clicked a link to participate (Appendix A). This link opened a new browser winder with the Qualtrics Survey. Participants received a brief introduction encouraging them to take their time and then they were provided an informed consent form (Appendix B).

The Ranking Activity: Expected Performance for Safety. After informed consent was obtained, a ranking activity, was used to collect expected performance data for each of the twelve brands (Appendix C). Participants were provided the following scenario:

“Imagine you are a passenger in a driverless car. It is fully autonomous, meaning there is no need for a human driver. This car was designed to drive itself on the road and operate in the same environments and conditions that a person could. You are traveling down the road and you see a pedestrian crossing the street in front of you. You believe the vehicle needs to stop for them.”

Then participants were asked to evaluate and rank the twelve brands based on their expectation for how an autonomous vehicle produced by each brand would perform in the above scenario. Participants ranked the automobile brands from 1 to 12, where 1 represented the vehicle that would be the *most safe* for themselves, the pedestrian, and all others on the road and 12 represented the *least safe* for themselves, the pedestrian, and all others on the road. These rankings were based on their current knowledge and expectations. The listed of automobile brands was presented in a randomized order for each participant.

The ranking measure was used because we were interested in how the provided list of brands compare to one another, on average. Though scoring each brand individually on a scale would have provided similar information, ranking encourages the incorporation of underlying associations and latent perceptions of the twelve brands in this particular evaluation.

As a supplement, participants were asked to provide a couple words of their own to describe the brand they ranked as most safe (1) in the ranking activity. This served a dual purpose because the free response format helped to identify participants who were providing inaccurate data and the qualitative responses provided insight for how people determined their responses. For example, one person who selected BMW as most safe (rank 1) stated: “It's a brand that I haven't heard of any problems with in a very long time. I would trust this brand the most to be able to have safe and functioning products.”.

The Rating Activity: Brand-Trust Associations. Then, participants completed Likert-style rating questions to measure relatedness between each automobile brand and each trust-based attribute, which as previously stated, we defined as brand-trust associations.

For each of the twelve brands, in randomized order, participants responded to the following question, “How related is <BRAND NAME> to each of the following?”. Twelve trust-based attributes were listed beneath this, and participants provided a relatedness rating for each attribute using a 7-point scale, where a score of 1 indicated *Not Related At All* and a score of 7 indicated *Extremely Related* (Appendix D). The list of trust-based attributes was presented in a randomized order for each participant.

In total, participants completed 144 pairwise comparison ratings which informed the relatedness data later used to quantify associations between each automotive brand and each trust-based attribute. The structure of this survey was adapted from the pairwise comparison task used by Branaghan and Hildebrand (2011). However, instead of participants comparing their self-image and 12 automobiles with the 15 dimensions and facets of Aaker’s Brand Personality Framework (1997), participants in the present study compared 12 automobile brands and the 12 attributes of Jian, Bisantz, and Drury’s scale to measure trust in automation (2000).

Finally, participations completed a demographics questionnaire to collect information regarding their gender, age, educational background, and automobile ownership. Three questions to measure components of interpersonal trust, brand preference behavior, and brand trust were also included (Appendix E).

Upon completion, participants were thanked for sharing their opinions, notified their participation was concluded, and Amazon Mechanical Turk would facilitate the compensation process by transfer their earnings to their account. This message included a unique survey code. Participants returned to the Amazon Mechanical Turk portal to enter their unique survey code into the space provided (Appendix A). Participants received their compensation within one to three days after submitting their unique survey code.

No identifying information was associated or linked to any individual responses. The Qualtrics survey was set up to ensure that IP Addresses were not recorded. The unique survey codes were the only link to a worker's ID, however, it was only used to approve survey completion and distribute compensation, it was deleted immediately after compensation was distributed.

CHAPTER 4

RESULTS

Expected Performance Measures

The ranking activity required all participants to put all twelve brands in order from most safe to least safe (1 to 12 respectively) based on their expectation for how an autonomous vehicle produced by each brand would perform. Since ranked position is an ordinal variable, the Friedman's test was conducted (Appendix F) as a non-parametric alternative to a repeated measures one-way ANOVA. The Friedman's test does not assume normally distributed samples. Therefore, it was used to determine whether there was a significant difference in ranked position between brands.

The Friedman's test revealed that there was a significant difference in ranked position between brands, $\chi^2(11) = 246.3$, $p < 0.00$. Median (IQR) and Mean (SD) ranked positions of each brand are listed in the table below.

Automobile Brand	Median	Mean (SD)
BMW	3	4.07 (2.90)
Mercedes	3	4.23 (2.90)
Tesla	3	4.64 (4.00)
Volvo	4	5.24 (3.26)
Toyota	6	5.92 (2.95)
Honda	6	6.14 (3.29)
Volkswagen	6	6.72 (3.12)
Ford	9	7.67 (3.30)
Nissan	8	7.75 (2.64)
Chevrolet	9	8.14 (2.85)
Mazda	9	8.57 (2.56)
Chrysler	9	8.92 (2.57)

Table 1. Median (IQR) and Mean (SD) ranked position

The test statistic of the Friedman's test is called the Friedman's Q and is notated with Chi-square. This test statistic represents and summarizes how far the average ranks are from one another and to what degree does the average explains the variance. Similar to the idea of variance, Friedman's Q would be zero if the mean ranks were equal to one another and would increase as the mean ranks become further apart.

The Friedman's Test is an omnibus test that revealed a significant difference between typical ranked position, however, it cannot identify which brands differed from one another. However, the frequency distributions for ranked position are shown for each brand in figure 3. The histograms are listed in order by mean ranked position. Therefore,

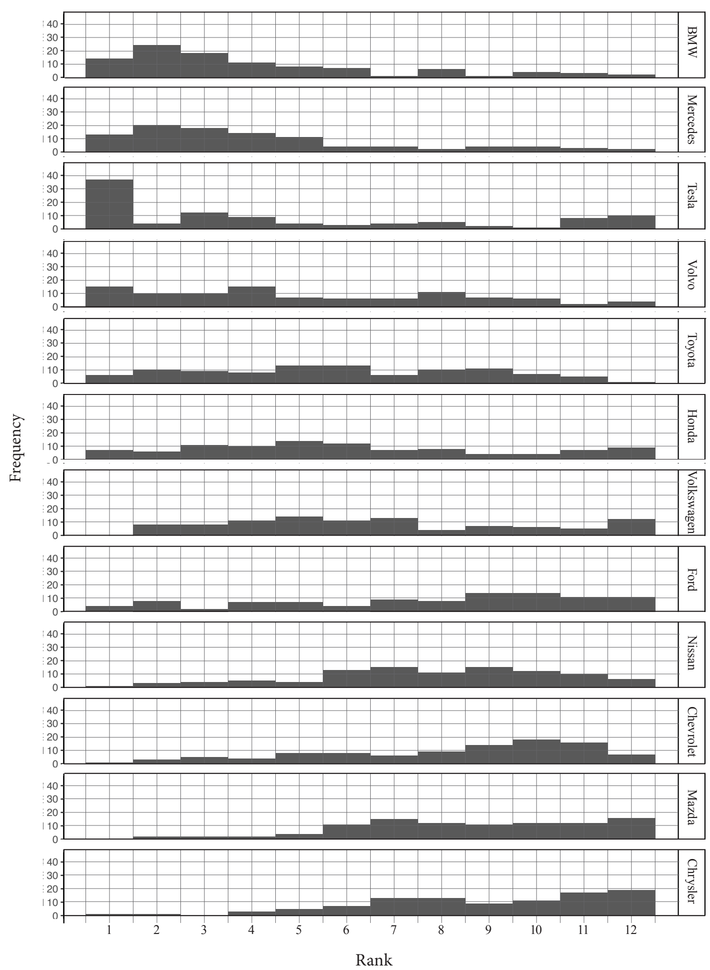

Figure 3: Histograms - Ranked Distributions

brands listed at the top of the chart tended to be ranked as more safe, and brands listed towards the bottom of the chart tended to be ranked as least safe (1 to 12 respectively).

Though the frequency distributions in figure 3 demonstrate a general trend, in order to explicitly determine which brands significantly differed from one another, the Wilcoxon Signed-Ranked test is needed for all 66 paired combinations. This is a non-parametric alternative to a paired-samples t-test.

A post hoc analysis conducted with Wilcoxon Signed-Ranked test and Bonferroni correction, was conducted to determine the effect of brand name on expected performance for safety (appendix F). The test revealed 36 significant differences in average ranked position between brand pairs. The remaining 30 pairs did not significantly differ from one another.

Figure 4 summarizes these findings. Figure 4 shows the groups brands that did not significantly differ from one another and divides brands that did significantly differ. For example, BMW (in red) is significantly different from all 8 brands outside of the red

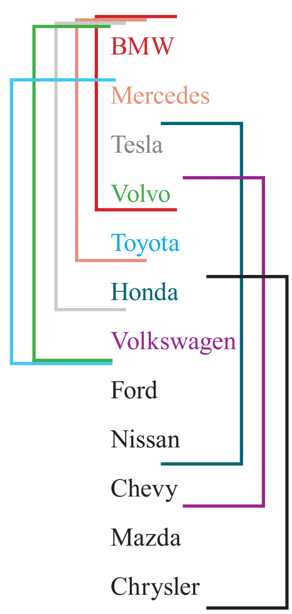

Figure 4: Significant differences in Ranked Position between brands

bracket and not significantly different from the 3 brands inside the red bracket (Mercedes, Tesla, Volvo). Furthermore, Volkswagen (in purple) is significantly different from all 5 brands outside of the red bracket and not significantly different from the 6 brands inside the red bracket (Volvo, Toyota, Honda, Ford, Nissan, Chevy).

Another component of the expected performance measure (ranking activity), was a supplementary free response question that asked participants to provide a couple of words to describe the brand they ranked as most safe (1 of 12). Therefore, counts were gathered for each brand based on the number of participants who ranked the brand as most safe (1 of 12). Of the 99 participants, 37 ranked Tesla, 15 ranked Volvo, 14 ranked BMW, 13 ranked Mercedes, 8 ranked Honda, 5 ranked Toyota, 4 ranked Ford, 1 ranked Nissan, 1 ranked Chevrolet, 1 ranked Chrysler, while no participants ranked Mazda nor Volkswagen as most safe (1 of 12).

A qualitative data analysis was conducted to identify themes in the brand descriptions. Within the responses, six major themes emerged. Brands that participants expected to perform most safe in the pedestrian example were noted to, *be the first brand to be successful in this space of automobile technology, be advanced and innovative brands in the automotive industry, in general, be high quality, or luxury automobile brands, have a good reputation for safety, be consistently reliable,* and *functional, in general.*

Of the 37 participants who expected Tesla to be the most safe, 12 attributed this to their belief that Tesla was the first brand to be successful in this space of automobile technology and 15 attributed this to their belief that Tesla is advanced and innovative brands in the automotive industry, in general. Of the 15 participants who expected Volvo to be the most safe, 14 attributed this to their belief that Volvo has a good reputation for safety**.** Of the 14 participants who expected BMW to be the most safe, participants were split. These participants thought BMW to be advanced and innovative brand in the automotive industry, a high quality, or luxury automobile brand, and consistently reliable. Of the 13 participants who expected Mercedes to be the most safe, 10 attributed this to their belief that Mercedes is a high quality, luxury brand. A summary table containing all counts for each theme facetted by brand can be found in Appendix H.

Brand-Trust Association Networks

The relatedness data from the brand trust rating activity in the survey was used to construct a Pathfinder network. Since, the survey collected relatedness ratings for all 12 brands and all 12 attributes, for a total of 144 attribute-brand ratings, the pairwise comparison ratings were first translated in Mat Lab using a scaling method to account for all 276 possible combination pairs consisting of attribute-brand, attribute-attribute, and brand-brand paired combinations.

This scaling method was used to derive relatedness measures for each brand-brand pair by using the Pearson Product Moment to correlate attribute ratings for each brand with each other brand. Similarly, trait-trait relatedness measures were calculated by correlating the automobile ratings for each attribute with every other trait. All relatedness measures were scaled by subtracting the minimum score on each scale from each individual score and then dividing that score by the maximum score on the scale. This translated the data to a normalized scale ranging from 0 to 1. The resulting data was combined into a n x n relatedness matrix and used as proximity data for the brand trust association network. This proximity data was used to calculate the distance between all twelve brands and all twelve trust-based attributes.

The Pathfinder Algorithm tool (downloaded at http://interlinkinc.net/index.html) was used to average all ratings, create a visual network of brand-trust associations, and explore patterns of brand-trust associations. The resulting network illustrates the underlying relationship patterns based on perceived relatedness of the twelve trust-based attributes and twelve brand names (see figure 4 below).

The network in figure 4 illustrates that brand trust associations and relative perceived trustworthiness tended to vary between automobile brands. For instance, BMW and Mercedes are directly associated to Confidence, one node connects them. Confidence is directly linked to Trustworthiness. BMW and Mercedes are also most disassociated with the attributes representing distrust.

Conversely, the network shows that Volkswagen is most closely related to distrusting attributes, such as, Deceptive, Underhanded, Harmful, Suspicious, and Beware, and most disassociated with Confidence and Trustworthiness. A summary table listing the number nodes between each item in the network can be found in Appendix I.

Similar to a benchmarking study where automobile manufacturers are interested in identifying how their brand compares to their competitors, this analysis provides insight for relative trust of individual brands.

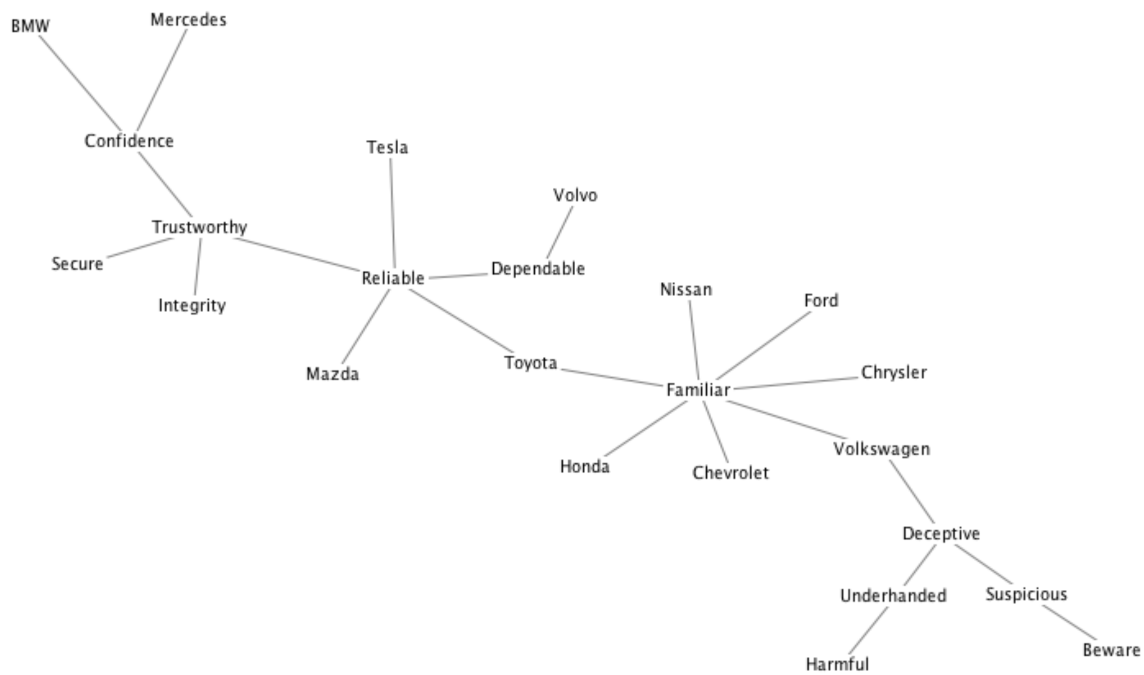

Figure 5: Pathfinder Network – Car Brands and Trust Associations (mean ratings, q=n-1, r=inf.)

To further investigate this relationship, the brand-trust relatedness data was transformed to examine the direct relatedness between brands, for example, "How related is <Tesla> to <Chrysler>". This was done because the twelve trust-based attributes initially developed by Jian, Bisantz, and Drury (2000) are centralized around the construct of trust, therefore, we see in the network that many of these trust-based attributes are more related to one another than they are to any car brand. The Nearest Neighbor Network derived using mean relatedness ratings of each of the brands is shown in figure 5. In this network we see groups of vehicles emerge, these groups are more related to one another than the other brands.

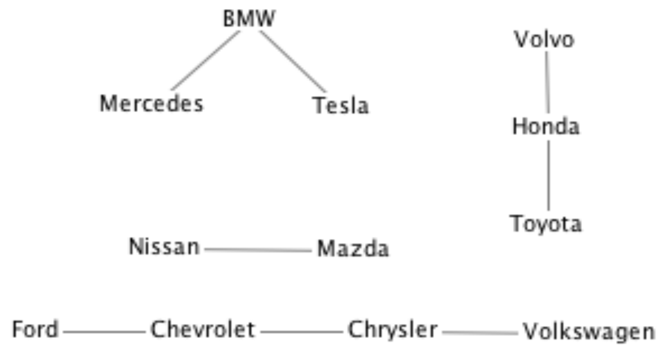

Figure 6: Nearest Neighbor Network – Car Brands (mean ratings, q=n-1, r=inf,)

The groups of brands that emerged in figure 6 are solely based on the relatedness ratings between the twelve brands and twelve trust-based attributes. They were collected independently of average ranked position. However, a few similarities emerged between the Nearest Neighbor Network (figure 6) and average ranked position (shown in table 1 and figure 4). Interestingly, the amount of overlap shown in figure 4 between the brand brackets somewhat matches to the groups that emerged in figure 6. Future work is needed to determine exactly how related the Nearest Neighbor Network is to average ranked position (results of the Wilcoxon Signed-Ranked test with a Bonferroni correction) for each brand. However, one observation that sticks out at first blush is that the top three brands in table 1 for average ranked position (BMW, Mercedes, Tesla) are the only three brands to have a median ranked position of 3 of 12. They also most related to each other in the network, in figure 6.

Correlation

A correlation analysis was used to explore the relationship between brand trust associations and performance expectations for safety. Brand trust associations were quantified by number of nodes between each trust-based attribute and each automobile brand in the pathfinder network. A table for this is shown in (Appendix I). Expected performance for safety was quantified by the average ranked position from most safe to least safe (1 to 12), average ranked position for each brand is shown in (table 1). It was hypothesized that a correlation between brand trust and expected performance would emerge.

This hypothesis was supported for ten of the twelve trust-based attributes. There was a significant positive correlation between average ranked position (median) and four of the trust-based attributes, Confidence ($r= 0.693$, $p< 0.05$), Secure ($r=0.605$, $p<0.05$), Integrity ($r=0.605$, $p<0.05$), and*, Trustworthy* ($r=0.605$, $p<0.05$). This indicated that, on average, brands who were more related to these components of trust also tended to be ranked as more safe.

Additionally, there was a significant negative correlation between average ranked position (median) and six of the twelve trust-based attributes, Harmful ($r=-0.636$, $p=0.026$), Deceptive ($r=-0.636$, $p=0.026$), Underhanded ($r=-0.636$, $p=0.026$), Suspicious ($r=-0.636$, $p=0.026$), Beware ($r=-0.636$, $p=0.026$) and Familiar ($r=-0.732$, $p=0.007$). This indicates a couple of things. First, on average, brands that were more related to components of distrust also tended to be ranked as less safe, on average. Additionally, the brands more related to familiarity also tended to be ranked as less safe.

The correlation between average ranked position (median) and two of the trust-based attributes was non-significant, Reliable ($r=0.15$, $p=0.642$) and Dependable ($r=0.261$, $p=0.413$). These words were more central to the brand-trust association network and therefore the number of nodes connecting to these attributes did not vary too much automobile brands.

These relationships were significant for both measure of central tendency, mean and median ranked positions (Appendix J).

CHAPTER 5

DISCUSSION

Overview

On average, participants predicted better performance for safety in brands associated with trust, and worse performance for brands associated with distrust. Results suggested that brands closely related to the attributes, Confidence, Secure, Integrity, and Trustworthiness were also expected to produce autonomous vehicle technology that performs in a safer way. Additionally, brands more related to the attributes Harmful, Deceptive, Underhanded, Suspicious, Beware and Familiar were also expected to produce autonomous vehicle technology that performs in a less safe way.

Limitations and Future Work

The present study does bear limitations. For instance, with survey data it is difficult to ensure that participants were attentive, honest, and appropriately understanding of the questions. The opportunity for a participant to provide an explanation for why they make the selections is limited and participants are unable to clarify or ask questions in they have any. Furthermore, only Mechanical Turk workers are included in the study therefore it is difficult to determine how well they reflect the general population of American drivers.

Additionally, in order to limit the length of the survey only of attribute-brand relatedness ratings were collected for a total of 144 questions in the rating activity. Therefore, attribute-attribute and brand-brand relatedness ratings had to be derived and scaled from the original data. It would be interesting to collect all 256 paired comparisons directly in the survey to verify the scaling method in this area of research. Similarly, only one scenario was used for the ranking activity to collect performance expectations. It would be interesting to explore performance expectations for safety between brands in other scenarios besides the pedestrian example. Further work could be done to see if expectations differ for brands in various situations such as, emergency braking or adaptive cruise control.

Additionally, individual differences should be further explored. Demographic information regarding gender, age, education level, personal car ownership, interpersonal trust, brand preference behavior, and brand trust were collected. Future work should be done to explore the potential influence of these factors on brand trust with autonomous vehicle technology and safety. For instance, the sample included 13 Toyota owners, 12 Honda owners, 10 Ford owners, 7 Nissan owners, 5 Chevrolet owners, 5 Mazda owners. Therefore, 52 of the 99 participant owned cars that made up the bottom middle rank in expected performance for safety and less associated with trusting attributes.

Furthermore, the Volkswagen brand is an interesting case for further exploration. This brand had a fairly spread distribution in expected performance for safety and no participants ranked this brand as most safe (rank 1). Measures of central tendency describe Volkswagen around the middle level of expected performance for safety. Though the brand association network illustrates distrusting associations, it would be interesting to know how many participants were aware that in 2016, Volkswagen was charged for illegal vehicle software that bypassed standards for diesel emissions (Boudette, 2017).

To further support the findings of the present study, future work should be done using a similar method. However, instead of collecting relatedness ratings between brands and trust-based associations, relatedness ratings should be collected for brands and Aaker's (1997) empirically derived dimensions of brand personality. This would allow for a comparison between trust associations and brand personality classifications.

Conclusions

Ultimately, autonomous vehicle system performance will always depend on the person who is interacting with it, their feelings and willingness to adapt their behavior and accept the system (Van Geenhuizen & Nijkamp, 2003). Theoretically, perceptions of trust tend to be based on aspects and expectations for system performance (Lee & See, 2004). Findings from the present study provide limited insight for people's expectations level of trustworthiness and performance for different brands of autonomous vehicle systems. Findings suggest that brand trust associations are related to expected performance for safety in branded autonomous vehicles.

Trust is important because it implicitly, and sometimes explicitly, informs a person's behavior towards a system. People need to make important decisions surrounding technology that directly impact their own safety, as well as others around them. If a person over trusts a system, they may rely on it in inappropriate ways. For instance, they may rely on it for tasks the system is not capable of, or not intended to do, and this can produce dangerous outcomes. For example, a pedestrian may decide to walk in front of a vehicle in a situation where the technology is unable to stop for them. The findings of this study show how different brands are associated with different levels and aspects of trust. These perceptions inform decisions, like whether to walk or not.

Conversely, under trusting the system can also be unsafe. Some systems may sound an alarm to notify people of various things, like an object in a blind spot or the need for a person to take over in certain driving conditions. For example, if a person disregards blind spot alarm and believes they know better than the system, a collision may occur. Additionally, if a person ignores a signal from the system indicating they should take control of the automation (drive manually), and they do not take control of the vehicle, this lack of vigilance and lack of trust in the alarming system can result in an accident.

This study shows that when compared to other brands, some brands are viewed with more confidence and trust when it comes to keeping people safe. Therefore, people may base their behaviors towards a system on their perceptions of the brand. More work should be done to gain a deeper understanding of these brand differences in trust for autonomous technology.

Additionally, this work should also encourage producers to be mindful of why trust in the automation produced by their brand is important. The system's capabilities and a person's expectations for the systems capabilities are important factors to consider, and they do not always match as well as they should. Safe systems communicate their capabilities to the person in an appropriate way, and this helps people know how to interact with the system. Producers should be mindful of this because it may ultimately affect the safety of their vehicle and its performance. Typically, corporations are focused on portraying their brand in a positive light. However, this study suggests that brand image and associations are important for more than just sales. This work provides a unique contribution to the branding literature, because it suggests that brand associations can impact an autonomous vehicle's performance and safety on the roadway.

Understanding brand trust associations, how they develop, and how they impact people's interactions with technology can help producers create systems in which a person's expectations for what the vehicle is capable of matches what the system is actually capable of. In this way, designing with trust-based expectations in mind may improve system safety for all parties involved.

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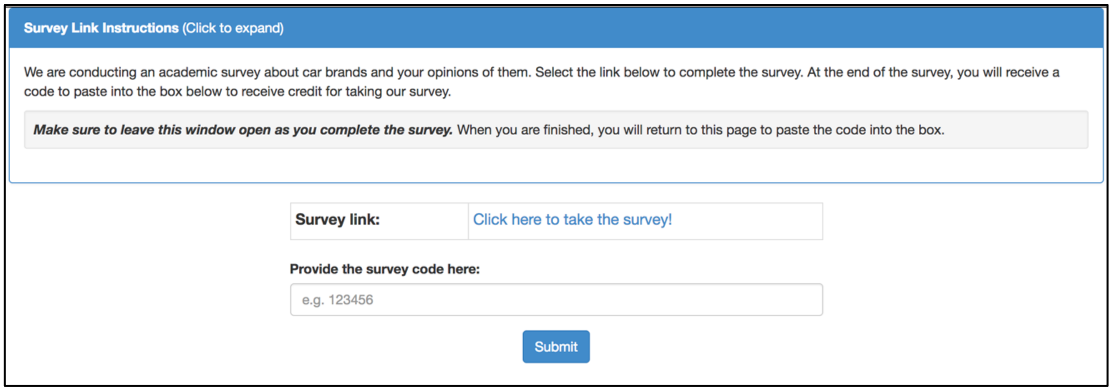
Example of Likert-style questions for Brand-Trust Association measures (Volvo)

APPENDIX A

AMAZON MECHANICAL TURK SURVEY LINK

HIT Title: Answer a survey about car brands!
HIT Description: This is a survey regarding various car brands and your opinions of them. This study will take about 30 minutes or less to complete. You will be compensated $1.00US for your time and honest participation. You must be at least 18 years old to participate.
HIT ID: 324N5FAHSYU0PK45BZJEF2YNGGFKVF



APPENDIX B

INFORMED CONSENT

CONSENT INFORMATION
Study: Brands of Autonomous Vehicles

PURPOSE: A brand is a name, term, or symbol used to differentiate a seller's product from others. This study aims to explore brands and the characteristics people tend to associate with them.

DESCRIPTION: If you decide to participate, this survey will take approximately 30 minutes or less to complete. You will be asked to complete a questionnaire consisting of *one* ranking activity and some ratings. Your responses will be a part of an academic research project about brand perceptions. You will receive $1.00US for completing this survey. In total, approximately 100 people will participate in this study.

BENEFITS: Benefits of your participation will possibly extend to the future of autonomous vehicle technology. Your responses and opinions will inform academic research for publication in the area of Human Systems Engineering.

COSTS AND PAYMENTS: We value your time. In order to thank you for your time participating in this research project, you will be paid $1.00US through Amazon Mechanical Turk.

RISKS: There are no known risks associated with this type of study.

CONFIDENTIALITY: Any information obtained in this study will be kept confidential. Results obtained from this study may be used in future presentations and publications. However, no identifying information will be used or recorded and none of your responses will be linked to you. All data will be stored electronically and will only be kept for a maximum of five years after the date of publication, as we will follow the standard academic research procedure.

CONTACT: The primary researcher is a graduate student at Arizona State University, in the Ira A. Fulton Schools of Engineering working under the direction of Dr. Russell Branaghan. If you have any questions regarding the study, you may contact the research team at Santa Catalina Hall, 7271 E Sonoran Arroyo Mall Mesa, AZ 85212. Phone: (480) 727-1390. If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

OPTION TO WITHDRAWAL: Your participation is voluntary. You may choose to leave now and not participate and, you have the right to stop and withdraw from the study at any time throughout the survey without penalty.

By clicking the -> button below, you state that you are at least 18 years old, you understand the study description above, and you provide consent to be part of this study.

← →

We value your opinion!

Please take your time to answer the following questions. Your responses will inform academic research for publication.

IF YOU ARE TAKING THIS SURVEY ON A MOBILE DEVICE: Allow the screen to rotate horizontally for a better experience.

→

APPENDIX C

RANKING ACTIVITY

Imagine you are a passenger in a driverless car. It is fully autonomous, meaning there is no need for a human driver. This car was designed to drive itself on the road and operate in the same environments and conditions that a human could. You are traveling down the road and you see a pedestrian crossing the street in front of you. You believe the vehicle needs to stop for them.

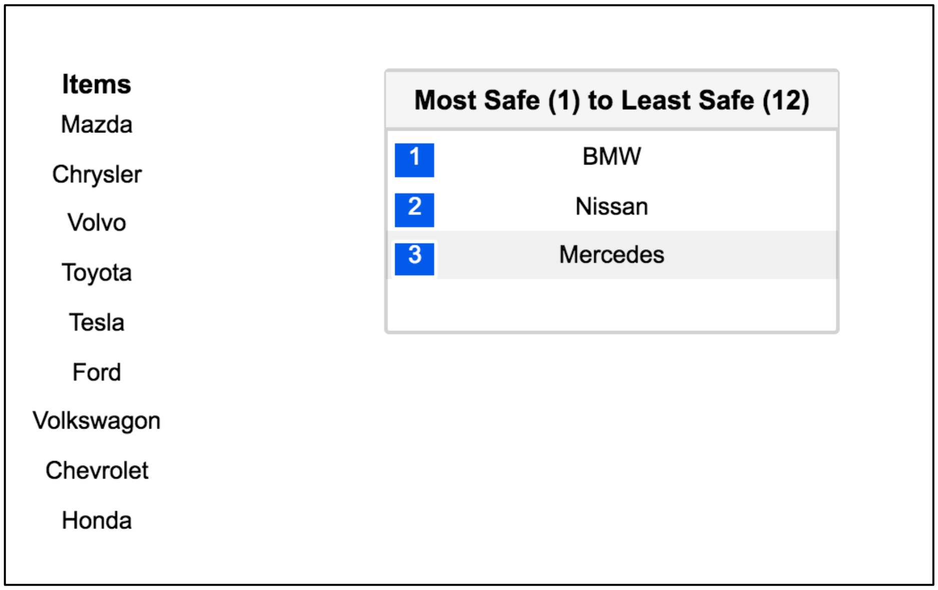
1 = If my autonomous vehicle was made by this brand, I'd expect it to react in a way that is *MOST SAFE* for me, the pedestrian and other cars on the road.

12 = If my autonomous vehicle was made by this brand, I'd expect it to react in a way that is *LEAST SAFE* for me, the pedestrian and other cars on the road.

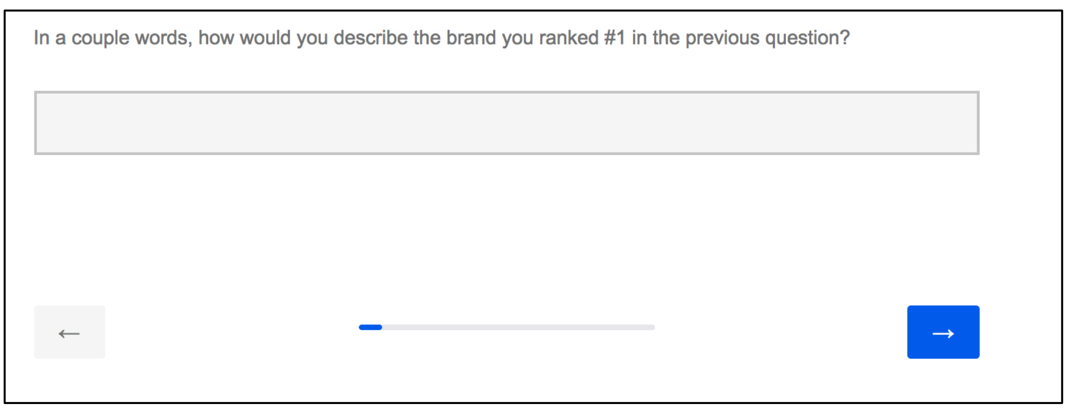
Please rank the following from 1 to 12 based on how you think an autonomous vehicle produced by each brand would perform. Click and drag each item into the box below to arrange them accordingly.

Items	Most Safe (1) to Least Safe (12)
Mazda	
Volvo	
Chrysler	
Mercedes	
Toyota	
Nissan	
Tesla	
Ford	
BMW	
Volkswagon	
Chevrolet	
Honda	

A number appeared next to each brand as it was dragged into the box. The number indicated the brand's ranked order position (as shown below).



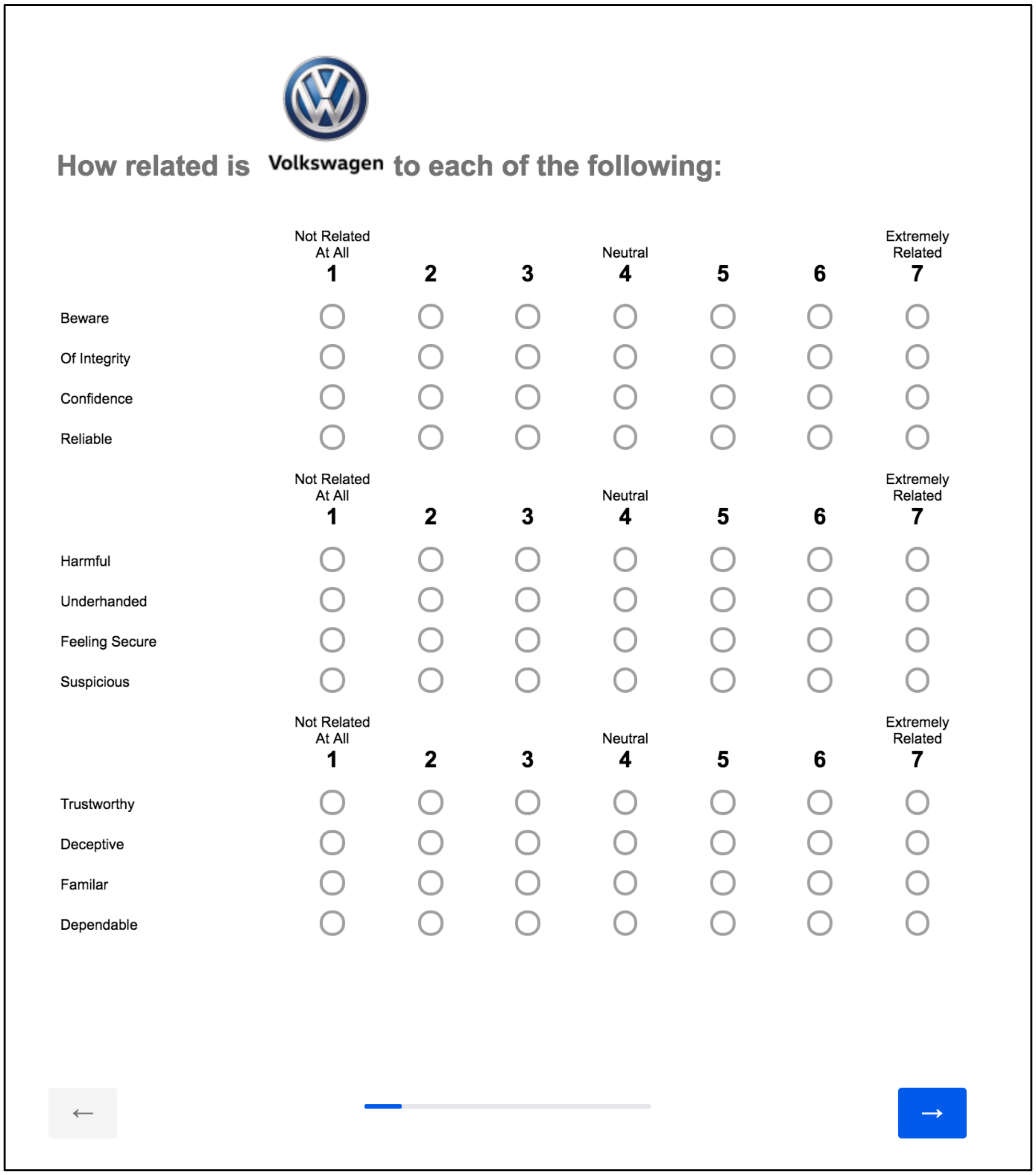
Rank 1 description (shown below)



APPENDIX D

RATING ACTIVITY

This structure was be repeated for all twelve automobile brands.



How related is Volkswagen to each of the following:

	Not Related At All 1	2	3	Neutral 4	5	6	Extremely Related 7
Beware	○	○	○	○	○	○	○
Of Integrity	○	○	○	○	○	○	○
Confidence	○	○	○	○	○	○	○
Reliable	○	○	○	○	○	○	○
	Not Related At All 1	2	3	Neutral 4	5	6	Extremely Related 7
Harmful	○	○	○	○	○	○	○
Underhanded	○	○	○	○	○	○	○
Feeling Secure	○	○	○	○	○	○	○
Suspicious	○	○	○	○	○	○	○
	Not Related At All 1	2	3	Neutral 4	5	6	Extremely Related 7
Trustworthy	○	○	○	○	○	○	○
Deceptive	○	○	○	○	○	○	○
Familar	○	○	○	○	○	○	○
Dependable	○	○	○	○	○	○	○

← →

APPENDIX E

DEMOGRAPHICS QUESTIONAAIRE AND END OF SURVEY

1. What is your Gender?
    - Male
    - Female
    - Other
    - I do not want to provide this information

2. What is your Age?
    - 18-24 years old
    - 25-34 years old
    - 35-44 years old
    - 45-54 years old
    - 55-64 years old
    - 65-74 years old
    - 75 years or older
    - I do not want to provide this information

3. Please select the highest level of education you have completed:
    - No schooling completed
    - Some high school, no diploma
    - High school diploma or the equivalent (for example: GED)
    - Some college, no degree
    - Trade/technical/vocational training
    - Associate degree
    - Bachelor's degree
    - Master's degree
    - Professional degree
    - Doctorate degree
    - I do not wish to provide this information

4. Are you a licensed driver?
    - Yes
    - No
    - I do not wish to provide this information

5. Do you own a car?
    - Yes
    - No
    - I do not wish to provide this information

(ONLY IF "Yes" to previous question)

6. What is the make of your primary vehicle (e.g, Jeep, Honda, Audi, Volvo, etc.)?

7. I think most people can be relied on to do what they say they will do.
   - 1: Strongly Disagree to 7: Strongly Agree

8. I have favorite brands (in general, not just car brands). I prefer their products over other brands.
   - 1: Strongly Disagree to 7: Strongly Agree

9. When it comes to my safety, I believe I can rely on some brands more than others.
   - 1: Strongly Disagree to 7: Strongly Agree

10. What type of device did you use to complete this survey?
    - Computer (desktop/laptop)
    - Mobile Phone
    - Tablet
    - Other
    - I do not wish to provide this information

END OF SURVEY

Your response has been recorded. Thank you for sharing your opinions!

Below is your Survey Code. Copy, Paste and Submit this code into the box on Mechanical Turk to receive your compensation.

Your survey code is:
2437323

Thank you!

APPENDIX F

FRIEDMAN'S TEST (WITH WILCOXON POST TESTS)

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles 25th	50th (Median)	75th
TESLA	99	4.64	4.004	1	12	1.00	3.00	8.00
HONDA	99	6.14	3.289	1	12	4.00	6.00	8.00
Volvo	99	5.24	3.255	1	12	2.00	4.00	8.00
Mercedes	99	4.23	2.899	1	12	2.00	3.00	5.00
Volkswagen	99	6.72	3.117	2	12	4.00	6.00	9.00
BMW	99	4.07	2.901	1	12	2.00	3.00	5.00
Toyota	99	5.92	2.951	1	12	3.00	6.00	8.00
Nissan	99	7.75	2.639	1	12	6.00	8.00	10.00
Mazda	99	8.57	2.556	2	12	7.00	9.00	11.00
Ford	99	7.67	3.301	1	12	5.00	9.00	10.00
Chevrolet	99	8.14	2.850	1	12	6.00	9.00	10.00
Chrysler	99	8.92	2.566	1	12	7.00	9.00	11.00

Friedman Test

Ranks

	Mean Rank
TESLA	4.64
HONDA	6.14
Volvo	5.24
Mercedes	4.23
Volkswagen	6.72
BMW	4.07
Toyota	5.92
Nissan	7.75
Mazda	8.57
Ford	7.67
Chevrolet	8.14
Chrysler	8.92

Test Statistics[a]

N	99
Chi-Square	246.301
df	11
Asymp. Sig.	.000

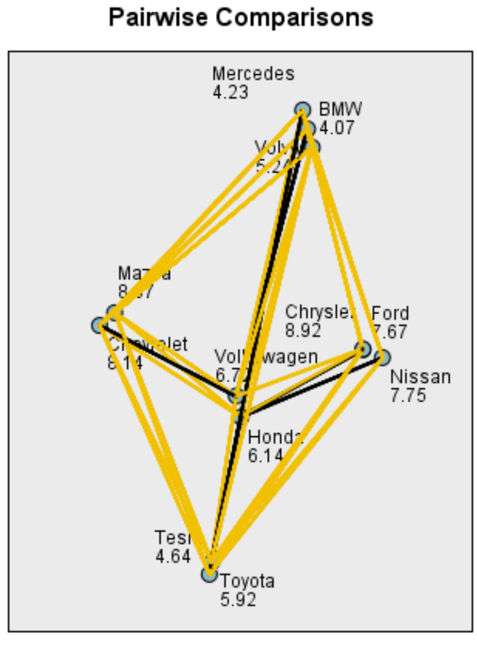
a. Friedman Test

Wilcoxon Post hoc with Bonferroni correction

Each node shows the sample average rank.

Sample1-Sample2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj.Sig.
BMW-Mercedes	.162	.512	.315	.752	1.000
BMW-Tesla	.566	.512	1.104	.270	1.000
BMW-Volvo	1.172	.512	2.286	.022	1.000
BMW-Toyota	-1.848	.512	-3.607	.000	.020
BMW-Honda	2.071	.512	4.041	.000	.004
BMW-Volkswagen	2.646	.512	5.164	.000	.000
BMW-Ford	-3.596	.512	-7.017	.000	.000
BMW-Nissan	-3.677	.512	-7.175	.000	.000
BMW-Chevrolet	-4.071	.512	-7.943	.000	.000
BMW-Mazda	-4.495	.512	-8.771	.000	.000
BMW-Chrysler	-4.848	.512	-9.461	.000	.000
Mercedes-Tesla	.404	.512	.788	.430	1.000
Mercedes-Volvo	1.010	.512	1.971	.049	1.000
Mercedes-Toyota	-1.687	.512	-3.292	.001	.066
Mercedes-Honda	1.909	.512	3.725	.000	.013
Mercedes-Volkswagen	-2.485	.512	-4.849	.000	.000
Mercedes-Ford	-3.434	.512	-6.702	.000	.000
Mercedes-Nissan	-3.515	.512	-6.859	.000	.000
Mercedes-Chevrolet	-3.909	.512	-7.628	.000	.000
Mercedes-Mazda	-4.333	.512	-8.456	.000	.000
Mercedes-Chrysler	-4.687	.512	-9.146	.000	.000
Tesla-Volvo	-.606	.512	-1.183	.237	1.000
Tesla-Toyota	-1.283	.512	-2.503	.012	.812
Tesla-Honda	-1.505	.512	-2.937	.003	.219
Tesla-Volkswagen	-2.081	.512	-4.060	.000	.003
Tesla-Ford	-3.030	.512	-5.913	.000	.000
Tesla-Nissan	-3.111	.512	-6.071	.000	.000
Tesla-Chevrolet	-3.505	.512	-6.840	.000	.000
Tesla-Mazda	-3.929	.512	-7.667	.000	.000
Tesla-Chrysler	-4.283	.512	-8.357	.000	.000
Volvo-Toyota	-.677	.512	-1.321	.187	1.000
Volvo-Honda	.899	.512	1.754	.079	1.000
Volvo-Volkswagen	-1.475	.512	-2.878	.004	.264
Volvo-Ford	-2.424	.512	-4.730	.000	.000
Volvo-Nissan	-2.505	.512	-4.888	.000	.000
Volvo-Chevrolet	-2.899	.512	-5.657	.000	.000
Volvo-Mazda	-3.323	.512	-6.485	.000	.000
Volvo-Chrysler	-3.677	.512	-7.175	.000	.000
Toyota-Honda	.222	.512	.434	.665	1.000
Toyota-Volkswagen	.798	.512	1.557	.119	1.000
Toyota-Ford	-1.747	.512	-3.410	.001	.043
Toyota-Nissan	-1.828	.512	-3.568	.000	.024
Toyota-Chevrolet	-2.222	.512	-4.336	.000	.001
Toyota-Mazda	-2.646	.512	-5.164	.000	.000
Toyota-Chrysler	-3.000	.512	-5.854	.000	.000
Honda-Volkswagen	-.576	.512	-1.123	.261	1.000
Honda-Ford	-1.525	.512	-2.976	.003	.193
Honda-Nissan	-1.606	.512	-3.134	.002	.114
Honda-Chevrolet	-2.000	.512	-3.903	.000	.006
Honda-Mazda	-2.424	.512	-4.730	.000	.000
Honda-Chrysler	-2.778	.512	-5.420	.000	.000
Volkswagen-Ford	-.949	.512	-1.853	.064	1.000
Volkswagen-Nissan	-1.030	.512	-2.010	.044	1.000
Volkswagen-Chevrolet	-1.424	.512	-2.779	.005	.360
Volkswagen-Mazda	-1.848	.512	-3.607	.000	.020
Volkswagen-Chrysler	-2.202	.512	-4.297	.000	.001
Ford-Nissan	.081	.512	.158	.875	1.000
Ford-Chevrolet	-.475	.512	-.926	.354	1.000
Ford-Mazda	.899	.512	1.754	.079	1.000
Ford-Chrysler	-1.253	.512	-2.444	.015	.958
Nissan-Chevrolet	-.394	.512	-.769	.442	1.000
Nissan-Mazda	-.818	.512	-1.597	.110	1.000
Nissan-Chrysler	-1.172	.512	-2.286	.022	1.000
Chevrolet-Mazda	.424	.512	.828	.408	1.000
Chevrolet-Chrysler	-.778	.512	-1.518	.129	1.000
Mazda-Chrysler	-.354	.512	-.690	.490	1.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .05.
Significance values have been adjusted by the Bonferroni correction for multiple tests.


Pairwise Comparisons
Mercedes
4.23
BMW
4.07
8.92
Ford
Nissan
7.75
6.14
4.64
Toyota
5.92

APPENDIX G

RANK DESCRIPTIVE STATISTICS

Frequencies

Statistics

		TESLA	HONDA	Volvo	Mercedes	Volkswagen	BMW	Toyota	Nissan	Mazda	Ford	Chevrolet	Chrysler
N	Valid	99	99	99	99	99	99	99	99	99	99	99	99
	Missing	1	1	1	1	1	1	1	1	1	1	1	1
Mean		4.64	6.14	5.24	4.23	6.72	4.07	5.92	7.75	8.57	7.67	8.14	8.92
Std. Error of Mean		.402	.331	.327	.291	.313	.292	.297	.265	.257	.332	.286	.258
Median		3.00	6.00	4.00	3.00	6.00	3.00	6.00	8.00	9.00	9.00	9.00	9.00
Mode		1	5	1[a]	2	5	2	5[a]	7[a]	12	9[a]	10	12
Std. Deviation		4.004	3.289	3.255	2.899	3.117	2.901	2.951	2.639	2.556	3.301	2.850	2.566
Variance		16.030	10.817	10.594	8.405	9.715	8.413	8.708	6.966	6.534	10.898	8.123	6.585
Skewness		.766	.338	.384	1.108	.316	1.175	.068	-.427	-.418	-.530	-.656	-.641
Std. Error of Skewness		.243	.243	.243	.243	.243	.243	.243	.243	.243	.243	.243	.243
Minimum		1	1	1	1	2	1	1	1	2	1	1	1
Maximum		12	12	12	12	12	12	12	12	12	12	12	12

a. Multiple modes exist. The smallest value is shown

Nissan

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	1.0	1.0	1.0
	2	3	3.0	3.0	4.0
	3	4	4.0	4.0	8.1
	4	5	5.0	5.1	13.1
	5	4	4.0	4.0	17.2
	6	13	13.0	13.1	30.3
	7	15	15.0	15.2	45.5
	8	11	11.0	11.1	56.6
	9	15	15.0	15.2	71.7
	10	12	12.0	12.1	83.8
	11	10	10.0	10.1	93.9
	12	6	6.0	6.1	100.0
	Total	99	99.0	100.0	
Missing	System	1	1.0		
Total		100	100.0		

Ford

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	4	4.0	4.0	4.0
	2	8	8.0	8.1	12.1
	3	2	2.0	2.0	14.1
	4	7	7.0	7.1	21.2
	5	7	7.0	7.1	28.3
	6	4	4.0	4.0	32.3
	7	9	9.0	9.1	41.4
	8	8	8.0	8.1	49.5
	9	14	14.0	14.1	63.6
	10	14	14.0	14.1	77.8
	11	11	11.0	11.1	88.9
	12	11	11.0	11.1	100.0
	Total	99	99.0	100.0	
Missing	System	1	1.0		
Total		100	100.0		

Mazda

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	2	2.0	2.0	2.0
	3	2	2.0	2.0	4.0
	4	2	2.0	2.0	6.1
	5	4	4.0	4.0	10.1
	6	11	11.0	11.1	21.2
	7	15	15.0	15.2	36.4
	8	12	12.0	12.1	48.5
	9	11	11.0	11.1	59.6
	10	12	12.0	12.1	71.7
	11	12	12.0	12.1	83.8
	12	16	16.0	16.2	100.0
	Total	99	99.0	100.0	
Missing	System	1	1.0		
Total		100	100.0		

Chevrolet

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	1.0	1.0	1.0
	2	3	3.0	3.0	4.0
	3	5	5.0	5.1	9.1
	4	4	4.0	4.0	13.1
	5	8	8.0	8.1	21.2
	6	8	8.0	8.1	29.3
	7	6	6.0	6.1	35.4
	8	9	9.0	9.1	44.4
	9	14	14.0	14.1	58.6
	10	18	18.0	18.2	76.8
	11	16	16.0	16.2	92.9
	12	7	7.0	7.1	100.0
	Total	99	99.0	100.0	
Missing	System	1	1.0		
Total		100	100.0		

Chrysler

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	1.0	1.0	1.0
	2	1	1.0	1.0	2.0
	4	3	3.0	3.0	5.1
	5	5	5.0	5.1	10.1
	6	7	7.0	7.1	17.2
	7	13	13.0	13.1	30.3
	8	13	13.0	13.1	43.4
	9	9	9.0	9.1	52.5
	10	11	11.0	11.1	63.6
	11	17	17.0	17.2	80.8
	12	19	19.0	19.2	100.0
	Total	99	99.0	100.0	
Missing	System	1	1.0		
Total		100	100.0		

TESLA

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	37	37.0	37.4	37.4
	2	4	4.0	4.0	41.4
	3	12	12.0	12.1	53.5
	4	9	9.0	9.1	62.6
	5	4	4.0	4.0	66.7
	6	3	3.0	3.0	69.7
	7	4	4.0	4.0	73.7
	8	5	5.0	5.1	78.8
	9	2	2.0	2.0	80.8
	10	1	1.0	1.0	81.8
	11	8	8.0	8.1	89.9
	12	10	10.0	10.1	100.0
	Total	99	99.0	100.0	
Missing	System	1	1.0		
Total		100	100.0		

HONDA

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	7	7.0	7.1	7.1
	2	6	6.0	6.1	13.1
	3	11	11.0	11.1	24.2
	4	10	10.0	10.1	34.3
	5	14	14.0	14.1	48.5
	6	12	12.0	12.1	60.6
	7	7	7.0	7.1	67.7
	8	8	8.0	8.1	75.8
	9	4	4.0	4.0	79.8
	10	4	4.0	4.0	83.8
	11	7	7.0	7.1	90.9
	12	9	9.0	9.1	100.0
	Total	99	99.0	100.0	
Missing	System	1	1.0		
Total		100	100.0		

Mercedes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	13	13.0	13.1	13.1
	2	20	20.0	20.2	33.3
	3	18	18.0	18.2	51.5
	4	14	14.0	14.1	65.7
	5	11	11.0	11.1	76.8
	6	4	4.0	4.0	80.8
	7	4	4.0	4.0	84.8
	8	2	2.0	2.0	86.9
	9	4	4.0	4.0	90.9
	10	4	4.0	4.0	94.9
	11	3	3.0	3.0	98.0
	12	2	2.0	2.0	100.0
	Total	99	99.0	100.0	
Missing	System	1	1.0		
Total		100	100.0		

Volvo

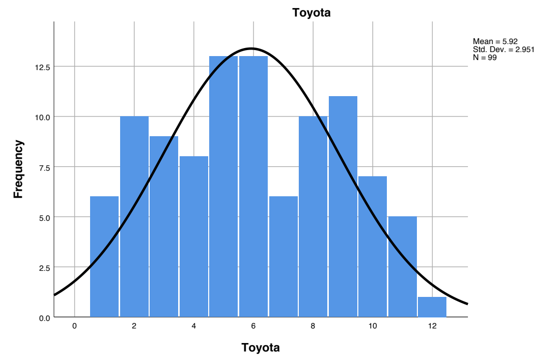
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	15	15.0	15.2	15.2
	2	10	10.0	10.1	25.3
	3	10	10.0	10.1	35.4
	4	15	15.0	15.2	50.5
	5	7	7.0	7.1	57.6
	6	6	6.0	6.1	63.6
	7	6	6.0	6.1	69.7
	8	11	11.0	11.1	80.8
	9	7	7.0	7.1	87.9
	10	6	6.0	6.1	93.9
	11	2	2.0	2.0	96.0
	12	4	4.0	4.0	100.0
	Total	99	99.0	100.0	
Missing	System	1	1.0		
Total		100	100.0		

Volkswagen

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	8	8.0	8.1	8.1
	3	8	8.0	8.1	16.2
	4	11	11.0	11.1	27.3
	5	14	14.0	14.1	41.4
	6	11	11.0	11.1	52.5
	7	13	13.0	13.1	65.7
	8	4	4.0	4.0	69.7
	9	7	7.0	7.1	76.8
	10	6	6.0	6.1	82.8
	11	5	5.0	5.1	87.9
	12	12	12.0	12.1	100.0
	Total	99	99.0	100.0	
Missing	System	1	1.0		
Total		100	100.0		

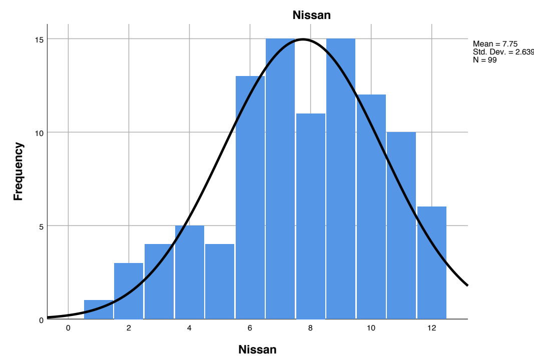
BMW

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	14	14.0	14.1	14.1
	2	24	24.0	24.2	38.4
	3	18	18.0	18.2	56.6
	4	11	11.0	11.1	67.7
	5	8	8.0	8.1	75.8
	6	7	7.0	7.1	82.8
	7	1	1.0	1.0	83.8
	8	6	6.0	6.1	89.9
	9	1	1.0	1.0	90.9
	10	4	4.0	4.0	94.9
	11	3	3.0	3.0	98.0
	12	2	2.0	2.0	100.0
	Total	99	99.0	100.0	
Missing	System	1	1.0		
Total		100	100.0		



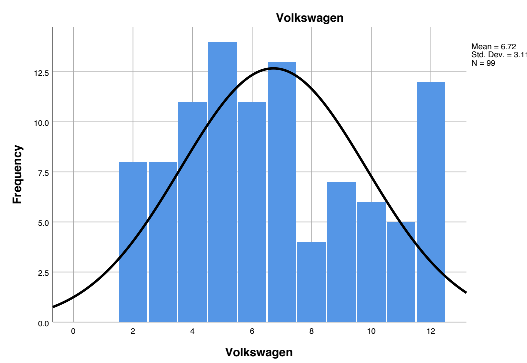
Toyota

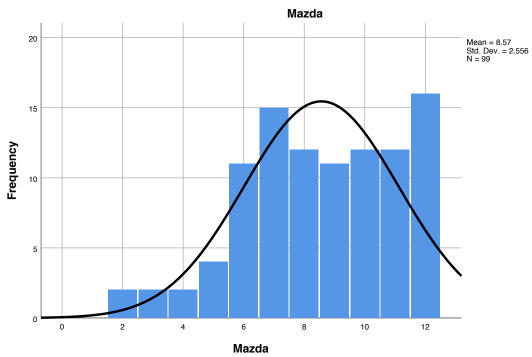
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	6	6.0	6.1	6.1
	2	10	10.0	10.1	16.2
	3	9	9.0	9.1	25.3
	4	8	8.0	8.1	33.3
	5	13	13.0	13.1	46.5
	6	13	13.0	13.1	59.6
	7	6	6.0	6.1	65.7
	8	10	10.0	10.1	75.8
	9	11	11.0	11.1	86.9
	10	7	7.0	7.1	93.9
	11	5	5.0	5.1	99.0
	12	1	1.0	1.0	100.0
	Total	99	99.0	100.0	
Missing	System	1	1.0		
Total		100	100.0		

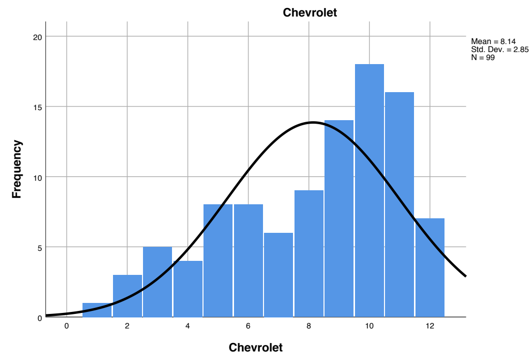


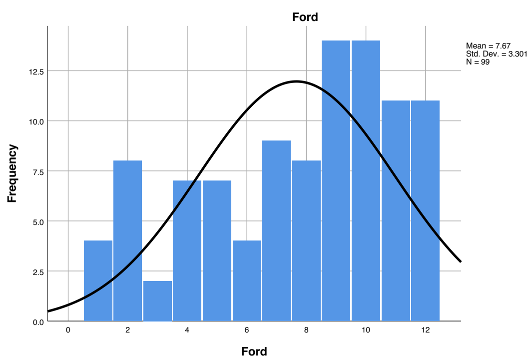
Nissan

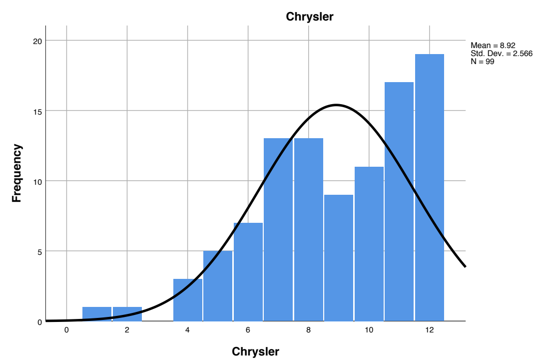
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	1.0	1.0	1.0
	2	3	3.0	3.0	4.0
	3	4	4.0	4.0	8.1
	4	5	5.0	5.1	13.1
	5	4	4.0	4.0	17.2
	6	13	13.0	13.1	30.3
	7	15	15.0	15.2	45.5
	8	11	11.0	11.1	56.6
	9	15	15.0	15.2	71.7
	10	12	12.0	12.1	83.8
	11	10	10.0	10.1	93.9
	12	6	6.0	6.1	100.0
	Total	99	99.0	100.0	
Missing	System	1	1.0		
Total		100	100.0		

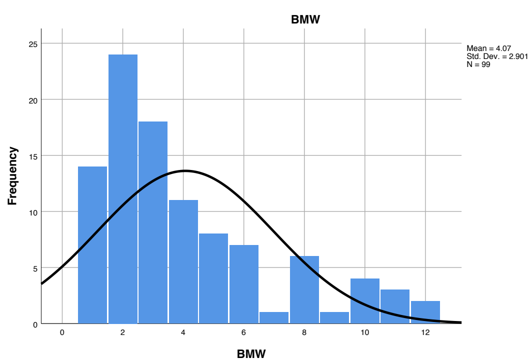


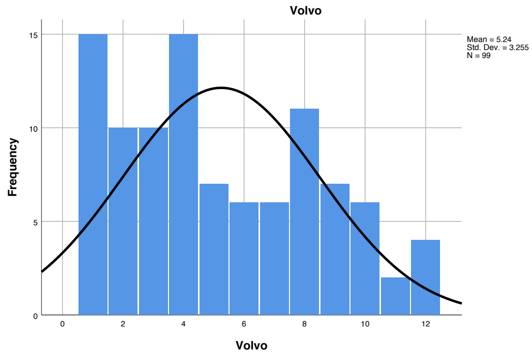

Mazda
Mean = 8.57
Std. Dev. = 2.556
N = 99
Frequency
Mazda

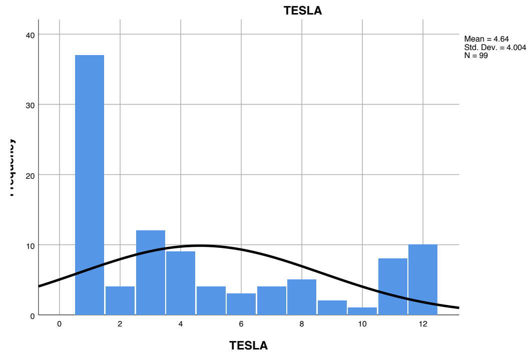

Chevrolet
Mean = 8.14
Std. Dev. = 2.85
N = 99
Frequency
Chevrolet

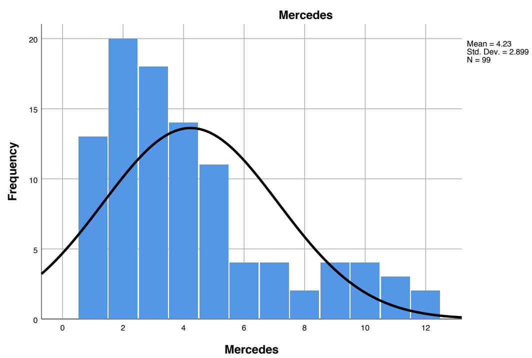

Ford
Mean = 7.67
Std. Dev. = 3.301
N = 99
Frequency
Ford

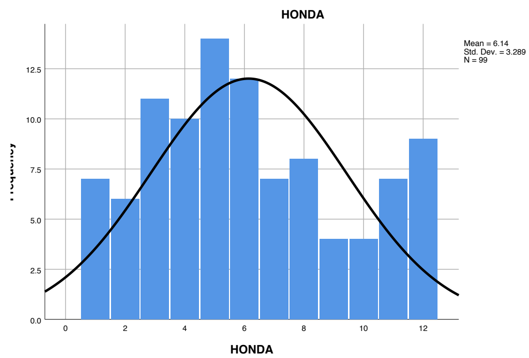

Chrysler
Mean = 8.92
Std. Dev. = 2.566
N = 99
Frequency
Chrysler


BMW
Mean = 4.07
Std. Dev. = 2.901
N = 99
Frequency
BMW


Volvo
Mean = 5.24
Std. Dev. = 3.255
N = 99
Frequency
0
5
10
15
0
2
4
6
8
10
12
Volvo


TESLA
Mean = 4.64
Std. Dev. = 4.004
N = 99
0
10
20
30
40
0
2
4
6
8
10
12
TESLA


Mercedes
Mean = 4.23
Std. Dev. = 2.899
N = 99
Frequency
0
5
10
15
20
0
2
4
6
8
10
12
Mercedes


HONDA
Mean = 6.14
Std. Dev. = 3.289
N = 99
0.0
2.5
5.0
7.5
10.0
12.5
0
2
4
6
8
10
12
HONDA

APPENDIX H

RANK 1 DESCRIPTIONS: SUMMARY TABLE

Automobile Brand	Rank 1 Frequency	Leaders, 1st brand in this space technology	Advanced & innovative brand in the automotive industry	High Quality; Luxury Brand	Reputation For Safety	Reliable Brand	Functional Brand
Tesla	37	12	15	7	3	0	0
Volvo	15	0	0	1	14	0	0
BMW	14	0	2	6	0	6	0
Mercedes	13	0	2	10	0	1	0
Honda	8	0	1	1	0	6	0
Toyota	5	0	0	0	3	2	0
Ford	4	0	0	0	0	4	0
Nissan	1	0	0	0	0	1	0
Chevrolet	1	0	0	0	0	1	0
Chrysler	1	0	0	0	0	0	1
Mazda	0	0	0	0	0	0	0
Volkswagen	0	0	0	0	0	0	0
Total	99	12	20	25	20	21	1

APPENDIX I

NUMBER OF NODES BETWEEN EACH BRAND AND EACH ATTRIBUTE

Brand	Confidence	Trustworthy	Secure	Integrity	Reliable	Dependable	Harmful	Familiar	Deceptive	Underhanded	Suspicious	Beware
BMW	1	2	3	3	3	4	9	5	7	8	8	9
Mercedes	1	2	3	3	3	4	9	5	7	8	8	9
Tesla	3	2	3	3	1	2	7	3	5	6	6	7
Volvo	4	3	4	4	2	1	8	4	6	7	7	8
Toyota	3	2	3	3	1	2	5	1	3	4	4	5
Honda	5	4	5	5	3	4	5	1	3	4	4	5
Volkswagen	5	4	5	5	3	4	3	1	1	2	2	3
Ford	5	4	5	5	3	4	5	1	3	4	4	5
Nissan	5	4	5	5	3	4	5	1	3	4	4	5
Chevrolet	5	4	5	5	3	4	5	1	3	4	4	5
Mazda	3	2	3	3	1	2	7	3	5	6	6	7
Chrysler	5	4	5	5	3	4	5	1	3	4	4	5

APPENDIX J

FULL CORRELATION MATRIX

Correlations

		Median_Rank	Mean_Rank	Confidence	Trustworth	Secure	Integrity	Reliable	Dependable	Harmful	Familiar	Deceptive	Underhanded	Suspicious	Beware
Median_Rank	Pearson Correlation	1	.977**	.693*	.605*	.605*	.605*	.150	.261	-.636*	-.732**	-.636*	-.636*	-.636*	-.636*
	Sig. (2-tailed)		.000	.013	.037	.037	.037	.642	.413	.026	.007	.026	.026	.026	.026
	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Mean_Rank	Pearson Correlation	.977**	1	.714**	.607*	.607*	.607*	.118	.211	-.637*	-.708**	-.637*	-.637*	-.637*	-.637*
	Sig. (2-tailed)	.000		.009	.036	.036	.036	.715	.511	.026	.010	.026	.026	.026	.026
	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Confidence	Pearson Correlation	.693*	.714**	1	.901**	.901**	.901**	.278	.194	-.837**	-.861**	-.837**	-.837**	-.837**	-.837**
	Sig. (2-tailed)	.013	.009		.000	.000	.000	.382	.546	.001	.000	.001	.001	.001	.001
	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Trustworth	Pearson Correlation	.605*	.607*	.901**	1	1.000**	1.000**	.667*	.541	-.732**	-.729**	-.732**	-.732**	-.732**	-.732**
	Sig. (2-tailed)	.037	.036	.000		.000	.000	.018	.069	.007	.007	.007	.007	.007	.007
	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Secure	Pearson Correlation	.605*	.607*	.901**	1.000**	1	1.000**	.667*	.541	-.732**	-.729**	-.732**	-.732**	-.732**	-.732**
	Sig. (2-tailed)	.037	.036	.000	.000		.000	.018	.069	.007	.007	.007	.007	.007	.007
	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Integrity	Pearson Correlation	.605*	.607*	.901**	1.000**	1.000**	1	.667*	.541	-.732**	-.729**	-.732**	-.732**	-.732**	-.732**
	Sig. (2-tailed)	.037	.036	.000	.000	.000		.018	.069	.007	.007	.007	.007	.007	.007
	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Reliable	Pearson Correlation	.150	.118	.278	.667*	.667*	.667*	1	.865**	-.183	-.137	-.183	-.183	-.183	-.183
	Sig. (2-tailed)	.642	.715	.382	.018	.018	.018		.000	.568	.671	.568	.568	.568	.568
	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Dependable	Pearson Correlation	.261	.211	.194	.541	.541	.541	.865**	1	-.308	-.277	-.308	-.308	-.308	-.308
	Sig. (2-tailed)	.413	.511	.546	.069	.069	.069	.000		.330	.384	.330	.330	.330	.330
	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Harmful	Pearson Correlation	-.636*	-.637*	-.837**	-.732**	-.732**	-.732**	-.183	-.308	1	.955**	1.000**	1.000**	1.000**	1.000**
	Sig. (2-tailed)	.026	.026	.001	.007	.007	.007	.568	.330		.000	.000	.000	.000	.000
	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Familiar	Pearson Correlation	-.732**	-.708**	-.861**	-.729**	-.729**	-.729**	-.137	-.277	.955**	1	.955**	.955**	.955**	.955**
	Sig. (2-tailed)	.007	.010	.000	.007	.007	.007	.671	.384	.000		.000	.000	.000	.000
	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Deceptive	Pearson Correlation	-.636*	-.637*	-.837**	-.732**	-.732**	-.732**	-.183	-.308	1.000**	.955**	1	1.000**	1.000**	1.000**
	Sig. (2-tailed)	.026	.026	.001	.007	.007	.007	.568	.330	.000	.000		.000	.000	.000
	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Underhanded	Pearson Correlation	-.636*	-.637*	-.837**	-.732**	-.732**	-.732**	-.183	-.308	1.000**	.955**	1.000**	1	1.000**	1.000**
	Sig. (2-tailed)	.026	.026	.001	.007	.007	.007	.568	.330	.000	.000	.000		.000	.000
	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Suspicious	Pearson Correlation	-.636*	-.637*	-.837**	-.732**	-.732**	-.732**	-.183	-.308	1.000**	.955**	1.000**	1.000**	1	1.000**
	Sig. (2-tailed)	.026	.026	.001	.007	.007	.007	.568	.330	.000	.000	.000	.000		.000
	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Beware	Pearson Correlation	-.636*	-.637*	-.837**	-.732**	-.732**	-.732**	-.183	-.308	1.000**	.955**	1.000**	1.000**	1.000**	1
	Sig. (2-tailed)	.026	.026	.001	.007	.007	.007	.568	.330	.000	.000	.000	.000	.000	
	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).