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Image-based Attribute Association in Market Research Surveys

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Image-based Attribute Association in Market Research Surveys

A thesis submitted in partial satisfaction
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Master of Applied Statistics

by

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ABSTRACT OF THE THESIS

Image-based Attribute Association in Market Research Surveys

by

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Master of Applied Statistics
University of California, Los Angeles, 2021
Professor Hongquan Xu, Chair

This paper explores methods of understanding the connection between culturally relevant images and descriptive characteristics that are attributed to them by US consumers. Using image associations as the primary means of measurement, I describe the perceptions of large multi-national consumer brands in the minds of US consumers. I directly compare image-association implied attributes of brands to traditional survey ratings scales of the same dimension. While this work is still preliminary and not instructing a particular strict methodology, it is necessary evidence that a connection can be made from descriptive characteristics to images to brand perception to brand ratings and attributed qualities.

The thesis of Garrett Blake Hoffman is approved.

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2021

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CHAPTER 1

Introduction

This paper seeks to better understand the relationship between culturally relevant images and attributable characteristics that describe them. Using images as stimuli for evaluating the brand image of large multi-national corporations, I describe whether a connection can be made between a brand's image, in the minds of US consumers, and implicit descriptive attributes that describe images they relate to.

Consumers generally have several predisposed opinions and understandings of what well known multi-national brands represent (Zhang, 2015). Brand image is important for an organization to understand and craft. The brands used in this research – Ford, Toyota, Microsoft, Apple, Coke, Pepsi, McDonalds, Taco Bell, Amazon, and Walmart – all have deep roots in the minds of American consumers. What they represent to the individual differs, but I use the premise that they have some meaning to those familiar as a way of exploring image attribute association.

With this research, I hope to understand the validity of images as non-verbal, projected, indicators of brand image. Methods that build on this research could have several advantages over common contemporary approaches. Images can provide a less direct comparisons to attributes, leveraging implied characteristics instead of explicitly stated attribute association. This can be used in place of traditional ratings scales, or as supplementary insights to current methods. Since images can represent several attributes at once, image-association studies can

increase the cost efficiency of surveys by simultaneously measuring many attributes in a single exercise.

Another key advantage of a potential resulting image-association methodology would come from reevaluation of image qualities and providing retroactive insights to previously completed surveys. When new attributes are studied and related to images previously evaluated, those relationships can be used to draw new insights from prior work. A database of images that is continually reevaluated against new and updated attributes would provide continued value over time to already completed research.

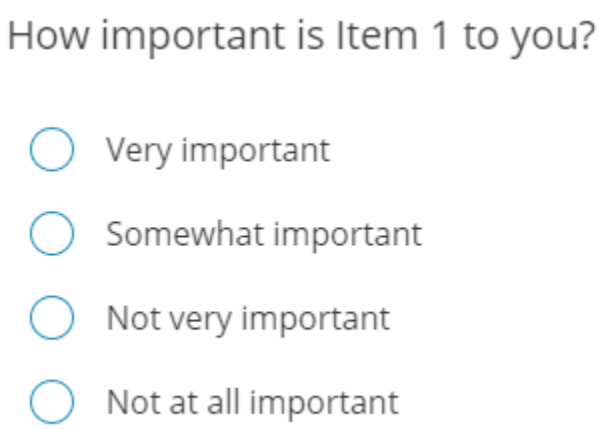
CHAPTER 2

Methodology & Considerations

Market researchers are often faced with a difficult choice of trying to balance testing a larger number of attributes/qualities with respondent fatigue during long surveys. This paper explores the idea of using culturally relevant images in place of typical ratings scales, and other common methods, in market research surveys. By applying industry-standard experimental methodologies to the new concept of image association, this method is more efficient than those commonly used in market research at drawing insights within a minimized amount of respondent time.

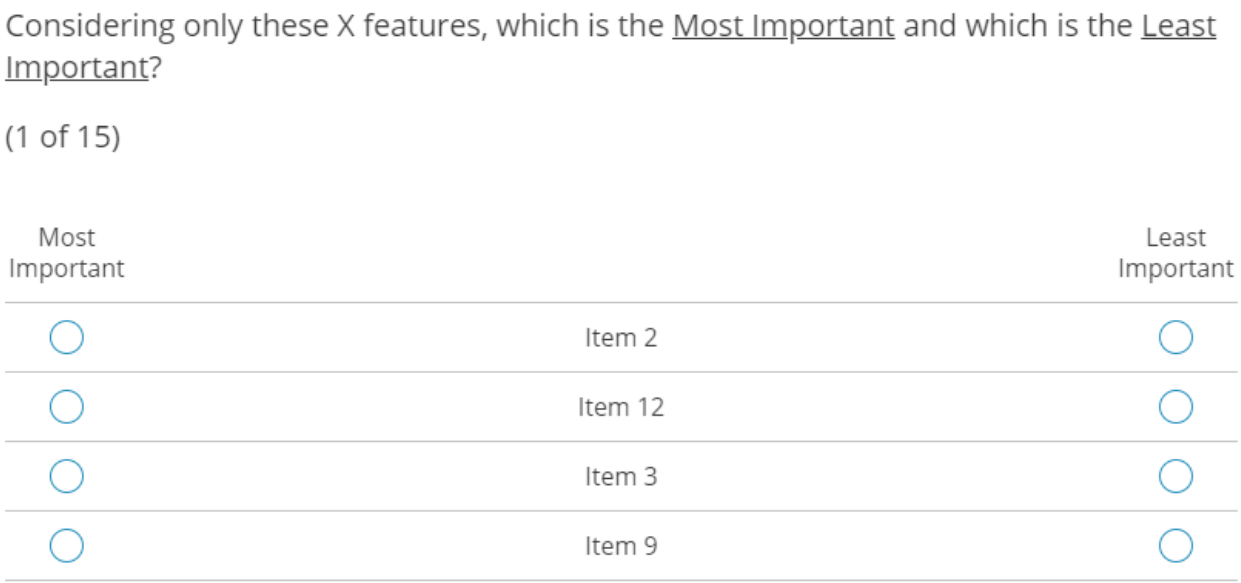
There is a problem in trusting ratings scale tasks, particularly in situations where there may be bias, or lack of discrimination (Brown, 2015). Ratings scales often suffer from a lack of validity and reliability across raters and subjects. By using choice experiments, and creating forced discrimination between items, these issues are reduced. It is easier to compare the weight of two items versus making an estimate of weight (or any dimension) based on a series of ratings scales. With pictures as stimuli, this decision is made easier for respondents.

Figure 2.1 Rating Scale Example Task Screen



Maximum Difference scaling (MaxDiff) experimental design (Finn & Louviere, 1992) is a widely used methodology in quantitative market research. By experimentally rotating a list of items and creating a forced choice between two dichotomous statements, researchers can create an ordinal list of items and measure distance between items. MaxDiff methodologies are used in market research studies because they offer detailed and useful insights from a series of tasks that are generally easy for survey respondents to understand and accomplish. This methodology has been shown to provide better predictability than its usual alternative, The Method of Paired Comparisons (Cohen & Orme, 2004). This paper utilizes a MaxDiff experimental design to measure the relationship between images and large multi-national consumer brands.

Figure 2.2 Traditional MaxDiff Example Task Screen

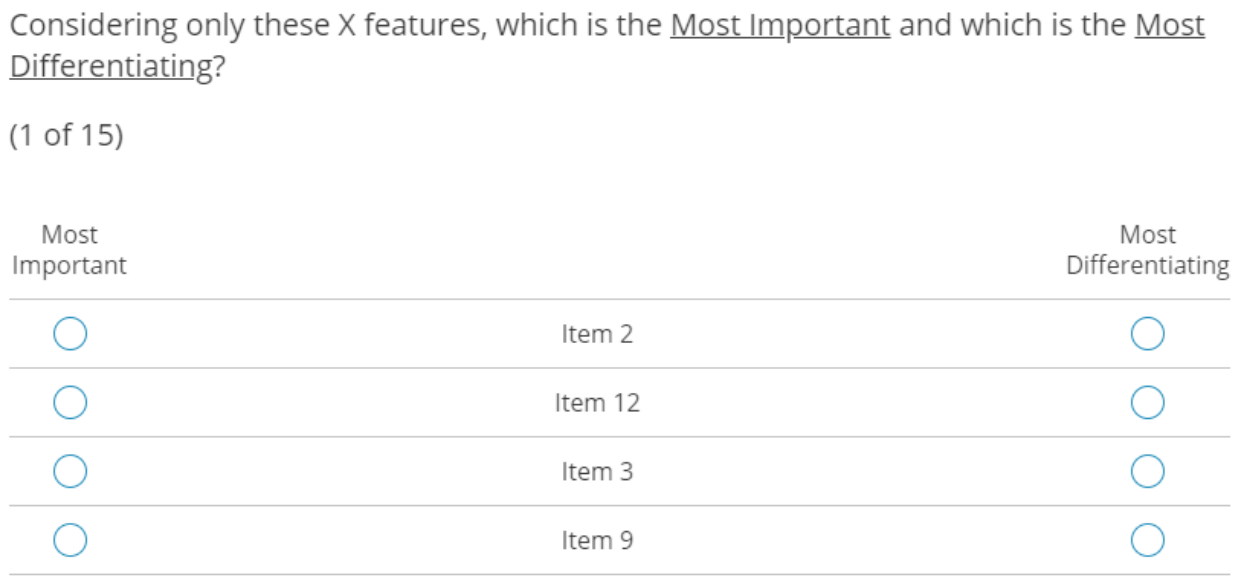


Measuring distance between item ratings is the most valuable advantage that the MaxDiff methodology holds over a typical ranked list or ratings scales. Researchers can understand the level of differentiation between items, which is important in determining actionable decisions that can be made from the analysis. Since MaxDiff designs typically break item lists into evaluations of 3-4 items at a time, respondents can evaluate smaller, more reasonable, sets of items in each MaxDiff task.

While the traditional MaxDiff methodology has proven to be useful tool in market research, it has several limitations. Respondent fatigue is a constant consideration in surveys of any type (Sharp & Frankel, 1983). Traditional MaxDiff studies can only test items on one dichotomous dimension at a time. Since a single MaxDiff with 20 items can take a survey respondent 8-10 minutes to evaluate, there typically is not enough time within the context of a larger survey to test multiple dimensions using multiple MaxDiff exercises.

There have been creative attempts at increasing the number of unique dimensions that can be studied in a MaxDiff exercise. Leveraging prior research on best-only MaxDiff methodologies (Marley & Louviere, 2005), StrateSci Inc. currently uses a methodology, the Duo MaxDiff, that tests two dimensions within the same MaxDiff tasks. By doing this, researchers can double the number of dimensions tested within a MaxDiff exercise, with only a small impact on data quality. My research builds on the understandings of best-only MaxDiffs and the Duo MaxDiff. In this paper, I test brand association with images using a modified best-only MaxDiff exercise.

Figure 2.3 Duo MaxDiff Example Task



Brands were chosen in matching industry pairs. I included brand pairs that should vary in their level of similarities. For example, since Amazon is an online retailer that offers other internet services and Walmart is most known for being a brick-and-mortar physical retailer, I expect that they are viewed quite differently. Since Coke and Pepsi have nearly identical US business models and retail presence, I expect them to be viewed similarly.

CHAPTER 3

The Data

3.1 SAMPLE AND DATA SOURCE

Previous work has been done on image-attribute association by StrateSci Inc. using paid sampling of US consumers through Amazon's Mechanical Turk. Crowdsourcing respondents is a fast and inexpensive way of collecting data. It allows researchers to study large samples of easy to recruit populations with fewer barriers than using traditional sample provider organizations. Respondents completed a MaxDiff exercise, where they evaluated which images, from a full set of 280 experimentally rotating images, most closely resemble a series of descriptive attributes. A subset of 20 images from this work was used in the brand association survey that followed. Data from this research was used to create relationships between the images and attributes tested. See images used in Table 7.1 Image Appendix.

Images were selected for the following brand association survey to have a mix of high and low association across the attributes leader, visionary, and innovator. Visionary and innovator currently have a greater number of highly associated images in the full image set than leader. Consequently, the leader attribute may not be as strongly measured with the image set that is available.

The brand evaluation survey, the primary focus of this paper, also uses paid sampling of US consumers through Amazon's Mechanical Turk. Several steps were taken to ensure response quality. Respondents were asked to perform basic tasks involving images of shapes

and math equations to confirm they are paying attention to the survey questions. Hidden fields were included periodically throughout the survey to remove any survey bots. Open ended responses about the brands were used as another way to verify proper respondent engagement, and to again confirm they are familiar with their assigned brands. A total combined sample of n = 651 US consumers were randomly assigned a brand pair to evaluate.

3.2 EVALUATED BRAND PAIRS

Ten large multi-national consumer brands were split into five brand pairs based on their shared industry. The five brand pairs, and their respective industries, were grouped as follows:

Pair 1: Ford & Toyota – automotive industry

Ford and Toyota are both major competitors in the US consumer automotive market. While they have competing products in many auto categories, they have several differentiating qualities that may create different perceptions in the eyes of consumers. Ford is a Michigan-based manufacturer with a history of selling cars in the US dating back to the Model T automobile in 1908. While Ford has manufactured many compact cars and sedans, they are maybe most recognized for the F-150 midsized pickup truck and several large SUV models. Toyota is a Japan-based manufacturer who is well known for their compact car and sedan offerings. They are particularly well known for being an early innovator and leading manufacturer in hybrid electric-gas autos with their popular Prius hybrid model.

Pair 2: Microsoft & Apple – consumer electronics industry

Microsoft and Apple are both fundamental players in shaping consumer electronics and computers since the personal computing revolution at the end of the 20th century. They represent two of the largest US companies sold on the New York Stock Exchange and compete across many products and services. Despite both companies offering many products and services in the consumer electronics industry, they are best known for very different flagship offerings.

Microsoft currently offers a range of Surface branded consumer devices and is a leader in cloud computing services. However, Microsoft is most well known for their industry-dominant Windows operating system and Office productivity suite, which includes the standard bearers in text processing and spreadsheet software. In addition to their consumer brand, Microsoft is a major provider of commercial software.

Apple is best known for their iPhone smartphone, Mac desktop & Macbook laptop computers, and iPad tablet devices. Their popular Apple OS desktop & iOS mobile operating systems, and an extensive personal device ecosystem and cloud service suite, are exclusively offered with Apple devices. Apple have an iconic brand image among many devoted technology fans and have a dichotomous relationship with Microsoft that is referenced regularly in marketing campaigns.

Pair 3: Coke & Pepsi – beverage industry

Coke and Pepsi both offer hundreds of individually branded beverage products in the United States. They are ubiquitous brands in American restaurants and grocery stores. Both have wide marketing campaigns across their product lines, appealing to many different

subgroups of American consumers. Both companies are likely best known for their namesake cola soda beverages, for which a preference of one over the other can be interpreted as having culturally relevant meaning. Other than marketing and subjective taste preferences, both have remarkably similar business models and distribution networks. They often compete directly against each other for product space in their retail locations.

Pair 4: McDonalds & Taco Bell – fast food industry

McDonalds and Taco Bell are both large chain locations in the US fast food market. McDonalds is well known for their hamburgers, fries, and American breakfast foods. Taco Bell is known for their various unique takes on tacos and burritos. Both brands have highly publicized, limited run, product launches and offer low cost “value menu” food items.

Pair 5: Amazon & Walmart – retail consumer goods

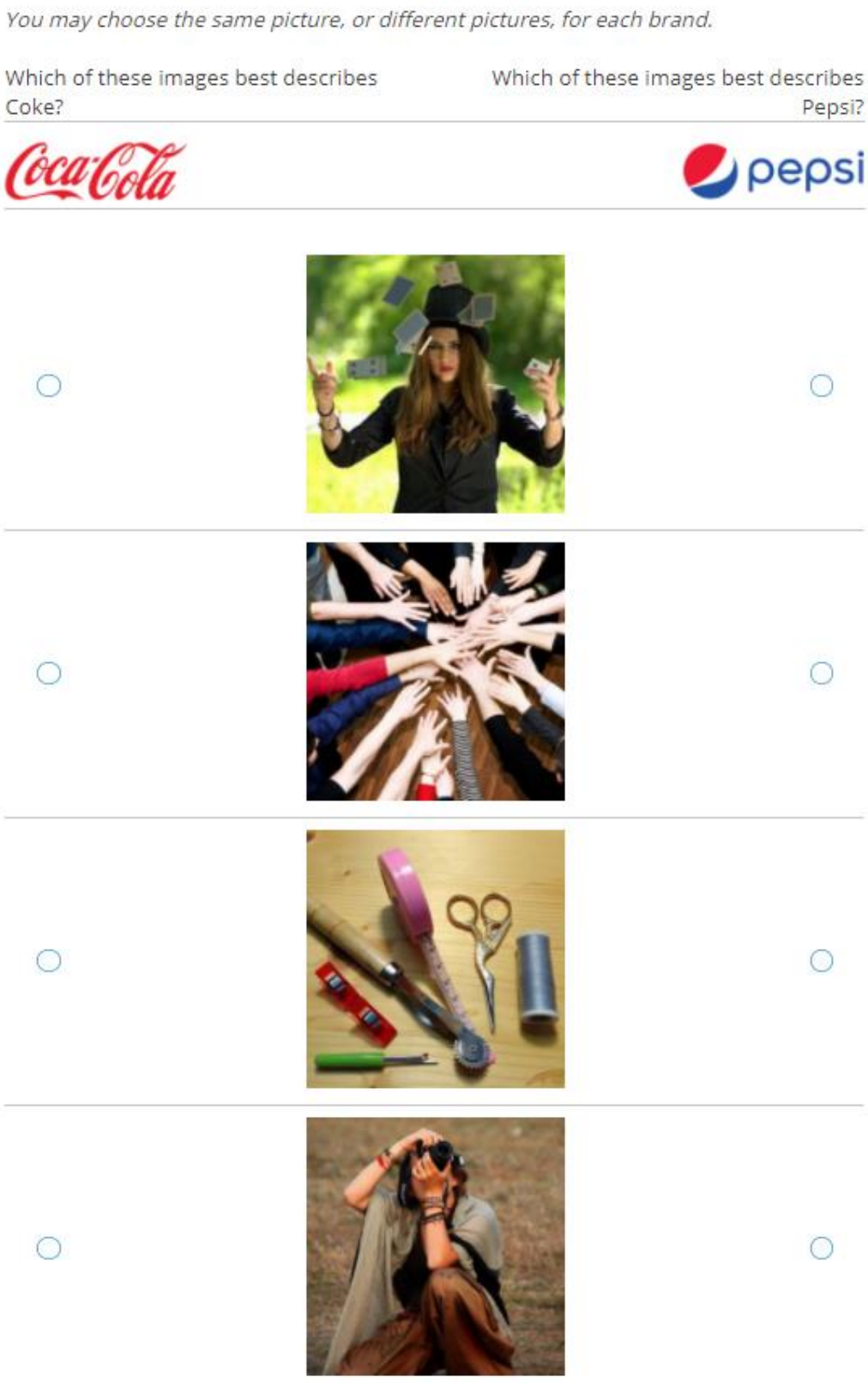
Walmart has a long-established brand as a department and grocery store chain. They are often credited for a major role in the popularization of large national department store chains of general retail goods in the United States. Amazon is, in many ways, an online variant of large national department store chains. Amazon offers many of the same products that Walmart offers, and has a presence in online grocery delivery services. Amazon and Walmart are competitors in the US online retail market, but Walmart is more typically known as a physical location retailer.

3.3 SURVEY FLOW

Respondents were first randomly assigned to a brand pair. Respondents were then asked their familiarity with each of the brands they were assigned to. Only respondents that reported being somewhat or very familiar with both assigned brands were able to continue.

After stating their familiarity with the assigned brands, respondents completed the MaxDiff exercise. Through a series of 15 tasks, experimentally rotating 20 images, respondents were asked which of four shown images best represented each of their assigned brands. Brand logos were included with the brand question prompts. Respondents were able to select the same image for both brands if they chose to.

Figure 3.1: Example MaxDiff Task Screen for Coke and Pepsi Brands



Following the MaxDiff exercise, respondents were asked to rate each brand on the three key attributes that are explored in this paper – leader, visionary, and innovator. Respondents were asked on a four-point scale, from strongly disagree to strongly agree, whether each brand they were evaluating 'is a leader', 'is a visionary', and 'is an innovator'. A four-point scale was used, instead of a 5-point Likert scale, to avoid neutral responses and create a forced choice. This evaluation was used to help validate the approach and understand whether brand associations with images described by these attributes have a similar relationship to explicitly stated ratings scales on the same attributes.

Finally, respondents were asked to describe each brand in three words. This was used as another measure of familiarity with brands and to confirm that respondents were giving thoughtful responses. Respondents with non-sensical answers were removed from the study.

3.4 SAMPLE SIZE

In total, 651 US consumers completed the survey. Respondents each evaluated one brand pair. The sample sizes for each brand pair are as follows:

- Pair 1, Ford & Toyota: n = 129
- Pair 2, Microsoft & Apple: n = 142
- Pair 3, Coke & Pepsi: n = 125
- Pair 4, McDonalds & Taco Bell: n = 127
- Pair 5, Amazon & Walmart: n = 128

CHAPTER 4

Results

Survey MaxDiff responses were first analyzed in a hierarchical Bayes multinomial logit model. Industry-standard Sawtooth hierarchical Bayes modelling software was used for the initial response analysis (Sawtooth Software, Inc., 2020). This provides individual respondent-level zero-centered utility scores, log-odds, for each image-brand pair. These zero-centered utilities form the primary metric that is used for image-brand association in the following results and analysis.

4.1 IMAGE ASSOCIATION SCORES

Table 4.1 Ford & Toyota Image Association Mean Utility and Odds

Image		Ford		Toyota	
Index	**Name**	**Mean Utility**	**Odds**	**Mean Utility**	**Odds**
1	Hiker	1.15*	0.76	0.12	0.53
2	Hands	0.01	0.50	0.57*	0.64
3	Monk	-1.75	0.15	-0.37*	0.41
4	Craftsman	1.57*	0.83	-0.54	0.37
5	Magician	-0.65	0.34	-0.97	0.27
6	Solider Helmet	0.24*	0.56	-0.75	0.32
7	Modern Soldiers	1.40*	0.80	-1.38	0.20
8	Computer Components	0.15	0.54	1.31*	0.79
9	Scientists Studying	-0.84	0.30	0.63*	0.65
10	Craft Tools	-0.70*	0.33	-1.44	0.19
11	Tiger	0.67*	0.66	-0.27	0.43
12	Businessman Coffee	0.41*	0.60	-0.03	0.49
13	Street Merchandise	-0.03*	0.49	-0.87	0.29

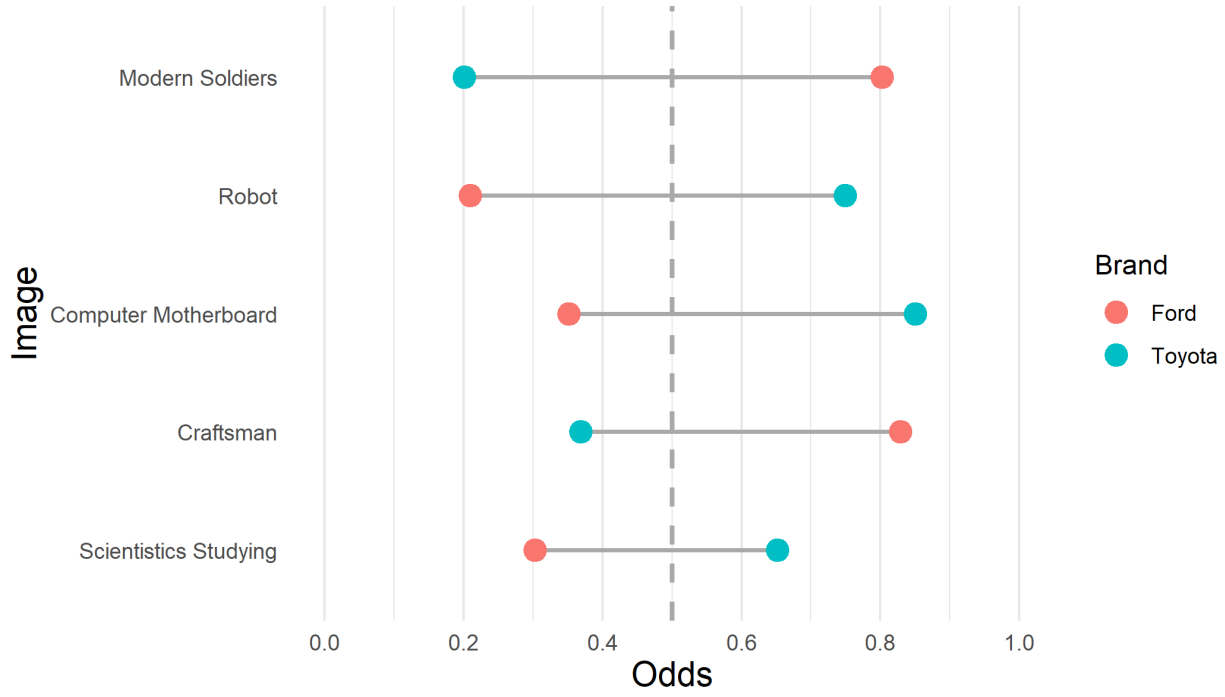
14	Wheat Mill	0.34*	0.58	-0.62	0.35
15	Robot	-1.33	0.21	1.10*	0.75
16	Microscope	-0.82	0.31	0.63*	0.65
17	Computer Motherboard	-0.61	0.35	1.74*	0.85
18	Photographer	-0.28	0.43	-0.30	0.42
19	Lightbulb	0.35	0.59	0.99*	0.73
20	Mountain Top	0.69	0.67	0.47	0.61

**Significantly greater than other brand at 95% confidence level*

Ford is best described by the images Craftsman (4), Modern Solders (7), and Hiker (1). Craftsman has a high score on the innovator attribute, Modern Soldiers scores high on the leader attribute, and Hiker scores high on the visionary attribute.

Toyota is most closely associated with the images Computer Motherboard (17), Computer Components (8), and Robot (15). Computer Motherboard and Robot score high on both visionary and innovator attributes. Computer Components scores moderately high across all three key attributes, especially innovator. Toyota has high association with images related to computers and modern technology.

Figure 4.1 Ford & Toyota Top Five Odds Differences



The largest difference in utility scores for Ford and Toyota are with the images Modern Soldiers (7), Robot (15), Computer Motherboard (17), and Craftsman (4). The images where Toyota scored higher than Ford, Robot and Computer Motherboard, as well as other images that are associated with Toyota generally relate to the attributes visionary and innovator. This could partially be due to Toyota's reputation of advancing the automotive industry through introducing new computer systems and engine designs that changes the form and function of today's automobiles. Despite offering many autos that are not heavily redesigned from the standard car and truck form, relative to Ford, Toyota is seen as a technology-forward innovative company.

The images where Ford scored higher than Toyota, Modern Soldiers and Craftsman, relate to different attributes, which gives Ford a less simple interpretation. Outside of the key attributes, Craftsman is also highly related to the attribute expert. Ford and Toyota are the only

evaluated brand pair where one company is American (Ford), and the other is non-American (Toyota, Japan). With the United States' higher current involvement in the defense industry and global military operations compared to Japan, the relationship US brands may have with military-themed images due to a perceived association between the brand and the United States could be a contributing influence. Ford and Toyota are the second least similarly rated brands in the study, with an average difference in mean utility of 1.14 across the 20 images.

Table 4.2 Microsoft & Apple Image Association Mean Utility and Odds

Image		Microsoft		Apple	
Index	**Name**	**Mean Utility**	**Odds**	**Mean Utility**	**Odds**
1	Hiker	-0.52	0.37	0.82*	0.69
2	Hands	0.15	0.54	1.10*	0.75
3	Monk	-1.83	0.14	-1.12*	0.25
4	Craftsman	0.03*	0.51	-0.23	0.44
5	Magician	-1.03	0.26	0.70*	0.67
6	Solider Helmet	-1.01*	0.27	-1.35	0.21
7	Modern Soldiers	-0.82*	0.31	-1.37	0.20
8	Computer Components	2.27*	0.91	0.23	0.56
9	Scientists Studying	1.09*	0.75	-0.44	0.39
10	Craft Tools	-0.63	0.35	-0.93	0.28
11	Tiger	-0.60	0.35	-0.28*	0.43
12	Businessman Coffee	0.56	0.64	0.45	0.61
13	Street Merchandise	-0.93*	0.28	-1.39	0.20
14	Wheat Mill	-0.72	0.33	-0.42	0.40
15	Robot	0.96	0.72	0.62	0.65
16	Microscope	1.12*	0.75	-0.43	0.40
17	Computer Motherboard	2.25*	0.91	0.67	0.66
18	Photographer	-0.54	0.37	1.03*	0.74
19	Lightbulb	0.56	0.64	1.17*	0.76
20	Mountain Top	-0.37	0.41	1.16*	0.76

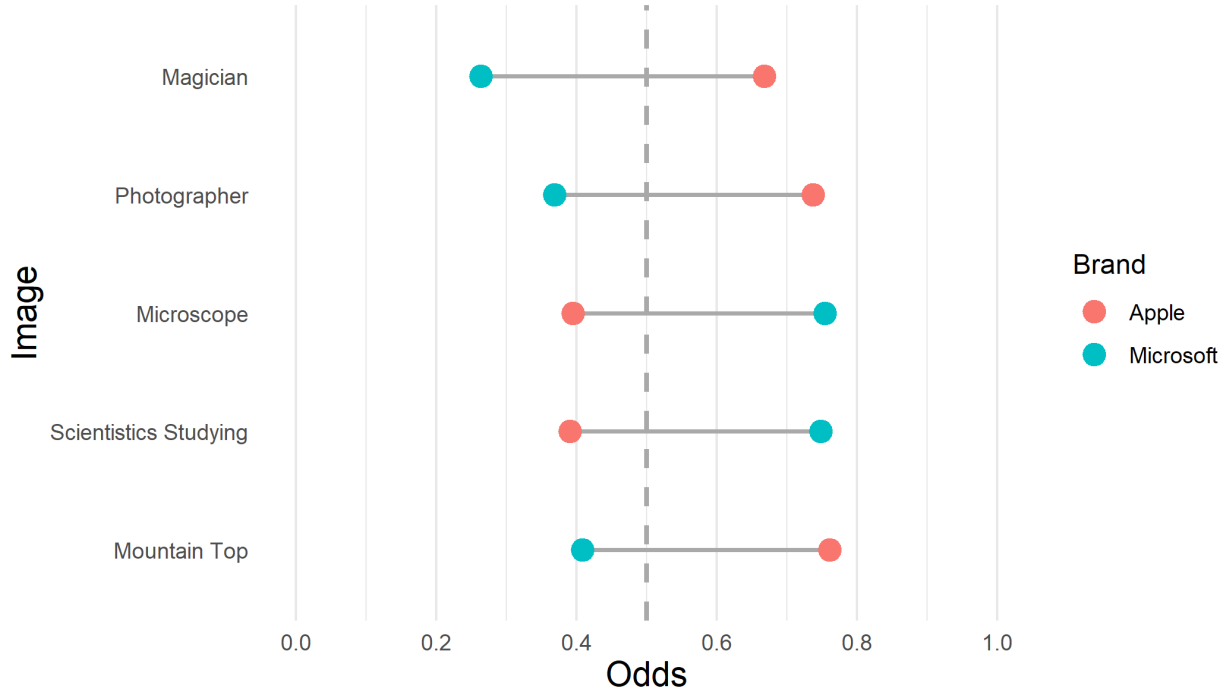
** Significantly greater than other brand at 95% confidence level*

Microsoft scores highest on the images Computer Components (8), Computer Motherboard (17), Microscope (16), and Scientists Studying (9). All images are associated with

the attributes visionary and innovator. Microsoft has a strong association with all images involving science, computers, and modern technology. This is expected given Microsoft's product offerings and broader brand image.

While Apple is primarily a technology and personal devices manufacturer, they do not have the same top images as Microsoft. Apple has the strongest relationship with the images Lightbulb (19), Mountain Top (20), Hands (2), and Photographer (18). They have a high association with many of the visionary and innovator images that do not feature computer hardware or science equipment. Apple's association with non-technology related images, while primarily being a personal device manufacturer, adds additional credibility to their brand image as a lifestyle brand as much as a technology provider.

Figure 4.2 Apple & Microsoft Top Five Odds Differences



Microsoft and Apple have their largest difference in mean utility across a varied set of images, including Microscope (16) where Microsoft has a higher score, and Magician (5) which is one of Microsoft's least related images. Microsoft's reputation as a productivity-focused software developer, and Apple's image as a sleek device manufacturer and cultural symbol are clearly displayed by their difference in image association. While Microsoft and Apple have substantial overlap across industry, they clearly have very different brand images in the minds of US consumers. Microsoft and Apple are the third least similarly rated brands in the study, with an average difference in mean utility of 0.91 across the 20 images.

Table 4.3 Coke & Pepsi Image Association Mean Utility and Odds

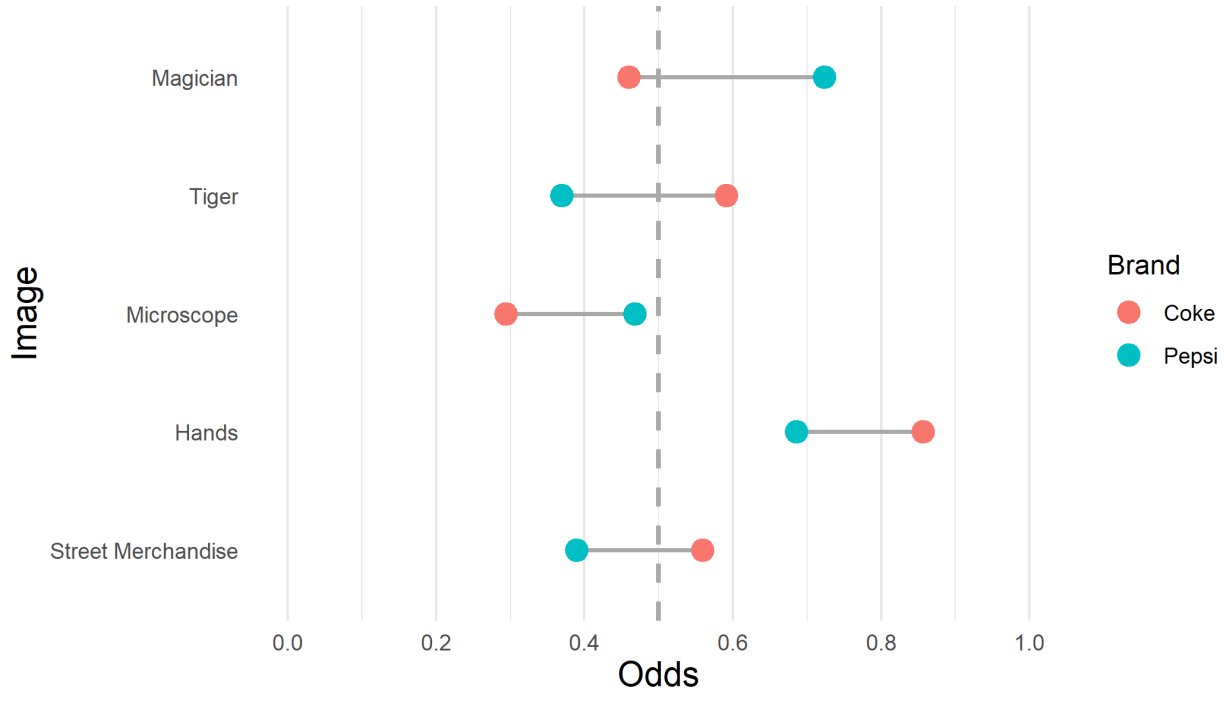
Image		**Coke**		**Pepsi**	
Index	**Name**	**Mean Utility**	**Odds**	**Mean Utility**	**Odds**
1	Hiker	1.29*	0.78	0.69	0.67
2	Hands	1.78*	0.86	0.78	0.69
3	Monk	-1.15	0.24	-0.79*	0.31
4	Craftsman	0.37*	0.59	-0.08	0.48
5	Magician	-0.16	0.46	0.96*	0.72
6	Solider Helmet	-0.48	0.38	-0.51	0.38
7	Modern Soldiers	-0.64	0.35	-0.88	0.29
8	Computer Components	-0.70	0.33	-0.35*	0.41
9	Scientists Studying	-0.46	0.39	-0.06*	0.49
10	Craft Tools	-0.92	0.28	-0.37*	0.41
11	Tiger	0.37*	0.59	-0.53	0.37
12	Businessman Coffee	0.35	0.59	0.45	0.61
13	Street Merchandise	0.24*	0.56	-0.45	0.39
14	Wheat Mill	0.29	0.57	0.23	0.56
15	Robot	-0.86	0.30	-0.14*	0.47
16	Microscope	-0.88	0.29	-0.13*	0.47
17	Computer Motherboard	-0.73	0.32	-0.88	0.29
18	Photographer	0.46	0.61	0.54	0.63
19	Lightbulb	0.59	0.64	0.72	0.67
20	Mountain Top	1.23*	0.77	0.79	0.69

** Significantly greater than other brand at 95% confidence level*

Coke scores highest on the images Hands (2), Hiker (1), and Mountain Top (20). Hiker and Mountain Top have similar relationships to the key attributes and are closely associated with visionary. Hands has a weaker, but still relatively strong association with visionary, while also being a top image for the leader attribute. Coke's high association with the image Hands, which features many hands and arms in a group huddle, reinforces the impact of marketing campaigns that prominently feature Coke products in scenes of fun with family and friends.

Pepsi has the strongest relationship with Magician (5), Mountain Top (20), Hands (2), and Lightbulb (19). Magician, Mountain Top, and Hands are all associated with visionary. Lightbulb is a top image for both visionary and innovator.

Figure 4.3 Coke & Pepsi Top Five Odds Differences



Coke and Pepsi is the second most similarly rated brands, out of the five brands tested, with an average difference in mean utility of 0.46 across the 20 images. Coke and Pepsi have very related product offerings, branding, and point of sale locations. This similarity shows with their relationships to the images. They are often the main US competitor of each other across products, differing most in marketing campaign strategy. The brands differ most on the images Magician (5) and Tiger (11), where Pepsi and Coke are rated higher, respectively. Otherwise, they are very similar. Coke is not typically associated with Magician but are related to all other images where Pepsi has odds greater than 0.5.

Table 4.4 McDonalds & Taco Bell Image Association Mean Utility and Odds

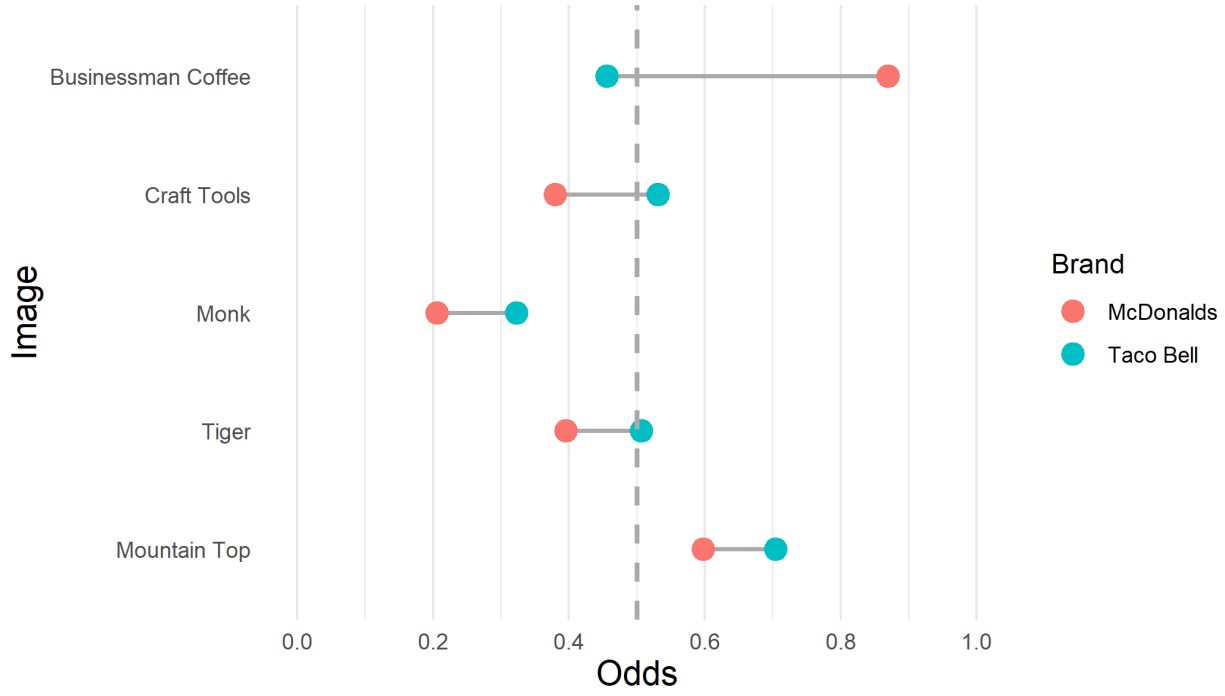
Image		**McDonalds**		**Taco Bell**	
Index	**Name**	**Mean Utility**	**Odds**	**Mean Utility**	**Odds**
1	Hiker	0.49	0.62	0.68	0.66
2	Hands	1.40*	0.80	0.91	0.71
3	Monk	-1.35	0.21	-0.74*	0.32
4	Craftsman	0.26	0.57	0.13	0.53
5	Magician	0.50	0.62	0.84*	0.70
6	Solider Helmet	-0.46	0.39	-0.21	0.45
7	Modern Soldiers	-0.96	0.28	-0.61*	0.35
8	Computer Components	-0.63	0.35	-0.69	0.33
9	Scientists Studying	-0.26	0.44	-0.27	0.43
10	Craft Tools	-0.49	0.38	0.12*	0.53
11	Tiger	-0.42	0.40	0.02*	0.51
12	Businessman Coffee	1.89*	0.87	-0.18	0.46
13	Street Merchandise	0.09	0.52	0.00	0.50
14	Wheat Mill	0.36	0.59	0.12	0.53
15	Robot	-0.18	0.45	-0.44	0.39
16	Microscope	-0.67	0.34	-0.31*	0.42
17	Computer Motherboard	-0.57	0.36	-0.54	0.37
18	Photographer	0.03	0.51	-0.11	0.47
19	Lightbulb	0.58	0.64	0.39	0.60
20	Mountain Top	0.40	0.60	0.87*	0.70

** Significantly greater than other brand at 95% confidence level*

McDonalds' top images are Businessman Coffee (12) and Hands (2). Both images are primarily related to the leader attribute. However, due to McDonalds strong brand connection to breakfast offerings and coffee, the presence of coffee in the Businessman Coffee image could be a reason for the particularly strong association.

Taco Bell is most closely related to Hands (2), Mountain Top (20), and Magician (5). All three images are related to the visionary attribute. Hands is also related to leader.

Figure 4.4 McDonalds & Taco Bell Top Five Odds Differences



McDonalds and Taco Bell are the most similarly rated brand pair in the sample, with an average difference in mean utility of just 0.37. The clear largest difference is with Businessman Coffee (12), which features a product McDonalds is known to advertise and Taco Bell is not known for carrying. Even accounting for this image, where McDonalds has a 2.07 higher mean utility, they remain the most similarly rated brands on average.

Table 4.5 Amazon & Walmart Image Association Mean Utility and Odds

Image		Amazon		Walmart	
Index	**Name**	**Mean Utility**	**Odds**	**Mean Utility**	**Odds**
1	Hiker	0.06*	0.52	-0.25	0.44
2	Hands	0.28	0.57	0.89*	0.71
3	Monk	-1.24	0.22	-0.92	0.28
4	Craftsman	-0.54	0.37	0.94*	0.72
5	Magician	-0.22	0.44	0.32*	0.58
6	Solider Helmet	-0.99	0.27	-0.18*	0.46
7	Modern Soldiers	-1.43	0.19	-0.40*	0.40
8	Computer Components	1.43*	0.81	-0.46	0.39
9	Scientists Studying	0.25*	0.56	-1.13	0.24
10	Craft Tools	-0.91	0.29	2.03*	0.88
11	Tiger	-0.21	0.45	-0.57	0.36
12	Businessman Coffee	0.59*	0.64	0.09	0.52
13	Street Merchandise	-0.64	0.35	1.46*	0.81
14	Wheat Mill	-1.39	0.20	0.57*	0.64
15	Robot	1.40*	0.80	-0.82	0.31
16	Microscope	0.46*	0.61	-0.64	0.35
17	Computer Motherboard	1.61*	0.83	-0.71	0.33
18	Photographer	0.12	0.53	-0.19	0.45
19	Lightbulb	0.90*	0.71	0.54	0.63
20	Mountain Top	0.46*	0.61	-0.58	0.36

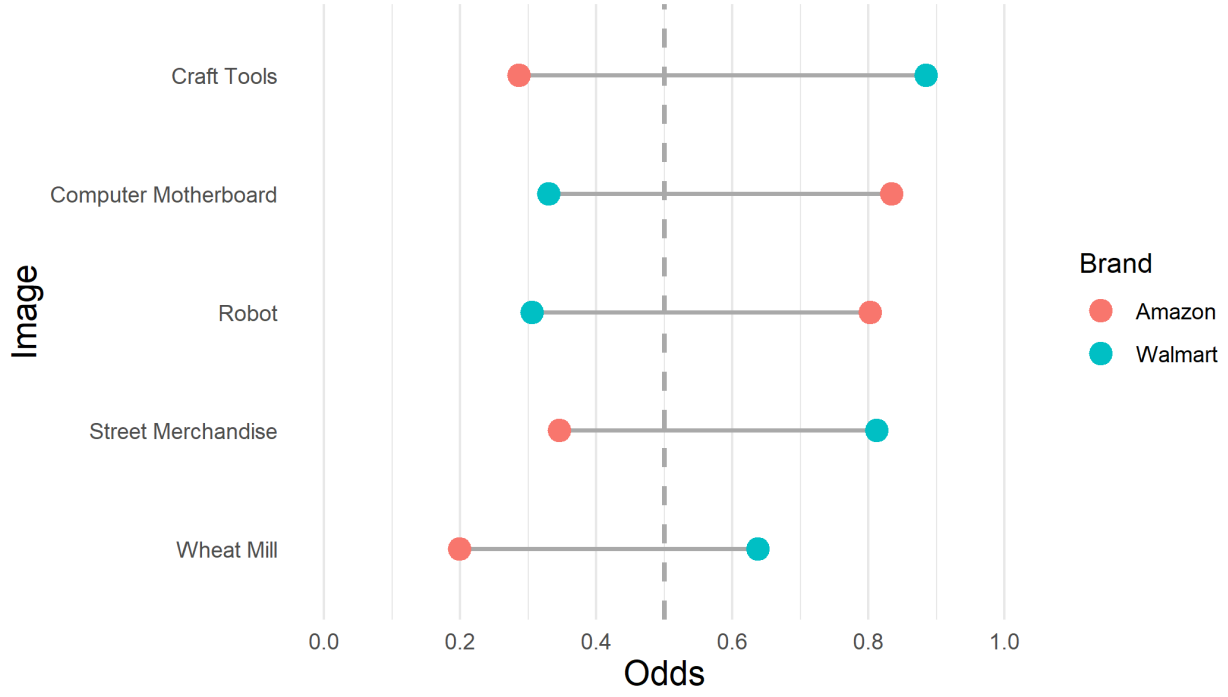
** Significantly greater than other brand at 95% confidence level*

Amazon's top images in the study are Computer Motherboard (17), Computer Components (8), and Robot (15). All images strongly relate to the innovator attribute. Since Amazon is primarily known as an online retailer and service provider, it makes sense to be most closely related to images that prominently feature circuits and computer hardware.

Walmart is most closely related to the images Craft Tools (10), Street Merchandise (13), Craftsman (4), and Hands (2). Craft Tools and Craftsman most closely relate to the innovator attribute. Hands relates to the leader and visionary attributes but is not among the strongest images for either attribute in the set. Craft Tools and Street Merchandise feature products that

could be sold at Walmart stores, which may be a contributing factor. However, the products in Craft Tools and Street Merchandise would likely also be sold through Amazon's online retail.

Figure 4.5 Amazon & Walmart Top Five Odds Differences



Amazon and Walmart are the least similarly rated brand pairs out of the five tested, with an average difference in mean utility of 1.18 across the image set. They most strongly differ across many of their respective top images, Craft Tools (10), Computer Motherboard (17), Robot (15), and Street Merchandise (13). Craftsman (4) and Wheat Mill (14), where Walmart scores substantially higher than Amazon, are some of the highest associated images, from the entire set of 280, with the attribute traditionalist. Although both companies have a presence in online retail, Walmart is not associated with innovation and technology nearly as much as Amazon. Amazon and Walmart are clearly viewed very differently in the minds of American

consumers, especially when compared to the other tested brand pairs. Walmart continues to be known for the brick-and-mortar retail business they helped popularize.

4.2 COMPOSITE SCORE CORRELATIONS

A binary variable was constructed for each image, determining if each respondents' utility score for the image is greater than zero, or more likely than the average image to be related to the each of the evaluated brands. A composite score of the binary image variables was created for each of the key attributes, using an average of the top four images for leader, visionary, and innovator from the previous study. For example, if a respondent had utility scores of 0.3, 0.2, -0.4, and 0.5 for Hands, Soldier Helmet, Tiger, and Businessman Coffee, they would have a binary value of 1, 1, 0, and 1 for each image respectfully. Following, they would have a composite average of 0.75 for the attribute leader.

Table 4.6 Image Attribute Choice Percentage

Image		**Percent Chosen***		
Index	**Name**	**Leader**	**Visionary**	**Innovator**
1	Hiker	28%	**72%**	34%
2	Hands	**63%**	56%	44%
3	Monk	47%	47%	6%
4	Craftsman	19%	31%	69%
5	Magician	3%	53%	47%
6	Solider Helmet	**59%**	16%	9%
7	Modern Soldiers	53%	19%	6%
8	Computer Components	47%	41%	72%
9	Scientists Studying	44%	56%	59%
10	Craft Tools	9%	44%	78%
11	Tiger	**69%**	13%	9%
12	Businessman Coffee	**63%**	34%	22%
13	Street Merchandise	6%	25%	25%

14	Wheat Mill	6%	31%	41%
15	Robot	28%	59%	**94%**
16	Microscope	34%	59%	**81%**
17	Computer Motherboard	25%	47%	**84%**
18	Photographer	16%	**75%**	50%
19	Lightbulb	25%	**81%**	**84%**
20	Mountain Top	34%	**72%**	25%

**Top four images for each attribute in bold*

Composite averages of the key attributes for each brand evaluation were then correlated to the explicit ratings scales respondents gave for whether they agreed or disagreed that each brand ‘is a leader’, ‘is a visionary’, and ‘is an innovator. The correlation for the innovator attribute is 0.21. The correlation for visionary is 0.15. The correlation for leader is 0. This work shows clearer evidence for a connection between innovator & visionary images and brand ratings scale evaluations of the same attributes than leader. The correlations for innovator and visionary are not high enough to confirm the method’s validity as a measure, but composite scores are not capturing a relationship between the leader images and the leader ratings scale at all.

Image availability is likely a contributing factor for why there is not a correlation with the leader attribute. The top four images in the leader composite were selected for leader between 59%-69% of the time in the previous study. Images in the visionary and innovator composites were selected between 72%-81% and 81%-94% of the time, respectively. Visionary and innovator composite images have a much higher level of association with their attributes than leader composite images.

4.3 RATINGS SCALE CORRELATIONS WITH INDIVIDUAL IMAGES

In this section, I detail the correlation between each brand's mean utility score for each image and ordinal ratings scales across the key attributes. Results are given for both the individual respondent-level correlations as well as the correlations after aggregating by brand.

Table 4.7 Individual Respondent-level Correlation between Mean Utility and Rating Scales

Image		**Correlation between Mean Utility & Rating**		
Index	**Name**	**Leader**	**Visionary**	**Innovator**
1	Hiker	0.05	0.03	0.04
2	Hands	0.12	0.05	0.07
3	Monk	-0.17	-0.12	-0.12
4	Craftsman	-0.09	-0.18	-0.15
5	Magician	-0.15	-0.10	-0.10
6	Solider Helmet	**-0.23**	**-0.23**	**-0.23**
7	Modern Soldiers	-0.19	**-0.20**	**-0.24**
8	Computer Components	0.13	0.15	0.15
9	Scientists Studying	0.11	0.16	0.15
10	Craft Tools	-0.18	**-0.22**	**-0.26**
11	Tiger	-0.01	0.00	0.03
12	Businessman Coffee	0.10	0.02	0.03
13	Street Merchandise	-0.16	**-0.24**	**-0.24**
14	Wheat Mill	-0.11	-0.16	-0.18
15	Robot	0.13	0.18	0.19
16	Microscope	0.08	0.16	0.14
17	Computer Motherboard	0.14	0.18	0.20
18	Photographer	0.02	0.08	0.09
19	Lightbulb	0.18	0.18	0.19
20	Mountain Top	0.14	0.13	0.14

**Correlations less than or equal to -0.2 or greater than or equal to 0.2 in bold*

At the individual respondent-level, with two brand observations from each of n = 651 respondents, most images do not appear to be strong positive indicators of the key attributes. No image has a correlation of 0.2 or more with leader, visionary, or innovator. However, several

images appear to be reasonable negative indicators of visionary and innovator. Modern Solders (7), Craft Tools (10), and Street Merchandise (13) all have a correlation of -0.2 or less with the attributes visionary and innovator. Soldier Helmet (6) has a negative correlation of less than -0.2 across all three key attributes. None of these correlations are particularly meaningful at the individual-respondent level. Analyzing these relationships at the individual-respondent level incorporates a lot of measurement error and lack of ratings consistency between individuals. Aggregating scores up to the brand aggregate level will help make the relationships clearer.

Table 4.8 Brand Aggregate-level Correlation between Mean Utility and Rating Scales

Image		**Correlation between Mean Utility & Rating**		
Index	**Name**	**Leader**	**Visionary**	**Innovator**
1	Hiker	-0.18	**-0.26**	-0.01
2	Hands	-0.05	-0.17	-0.08
3	Monk	**-0.37**	-0.12	-0.12
4	Craftsman	**-0.35**	**-0.72**	**-0.62**
5	Magician	**-0.47**	**-0.34**	**-0.40**
6	Solider Helmet	**-0.62**	**-0.89**	**-0.76**
7	Modern Soldiers	**-0.36**	**-0.63**	**-0.50**
8	Computer Components	**0.55**	**0.70**	**0.60**
9	Scientists Studying	**0.32**	**0.62**	**0.51**
10	Craft Tools	**-0.48**	**-0.63**	**-0.73**
11	Tiger	0.02	-0.19	0.08
12	Businessman Coffee	**0.35**	0.13	0.04
13	Street Merchandise	**-0.40**	**-0.77**	**-0.71**
14	Wheat Mill	**-0.68**	**-0.90**	**-0.83**
15	Robot	**0.57**	**0.87**	**0.71**
16	Microscope	**0.30**	**0.60**	**0.44**
17	Computer Motherboard	**0.63**	**0.82**	**0.70**
18	Photographer	0.11	**0.23**	**0.30**
19	Lightbulb	**0.51**	**0.76**	**0.70**
20	Mountain Top	0.00	0.13	**0.33**

**Correlations less than or equal to -0.2 or greater than or equal to 0.2 in bold*

At the brand-aggregate level, there is stronger evidence of a relationship between the image-brand association and the brands perception as a leader, visionary, and/or leader. Computer Components (8), Scientists Studying (9), Robot (15), Microscope (16), Computer Motherboard (17), and Photographer all have a correlation of 0.3 or more with each key attribute. Craftsman (4), Magician (5), Soldier Helmet (6), and Modern Soldiers (7), Craft Tools (10), Street Merchandise (13), and Wheat Mill (14) all have correlations of -0.3 or less with all attributes.

Reliability of ratings is much stronger at the brand level. With each brand having a minimum of n=125 observations, much of the error and other noise from individual respondent inconsistencies is filtered out when aggregating. This makes the relationships clearer. Since only ten brands were evaluated in this study, brand-aggregate correlations are not enough on their own to provide adequate evidence of a relationship image-association has with leader, visionary, and innovator attributes. However, given the high level of correlation many of the tested images have with the key attributes, more brands and respondents would help validate the relationships.

There is a lack of differentiation between the attributes when relating image association to the brand ratings scales. Images that positively relate to one of the key attributes positively relate to all of the key attributes. Conversely, images that negatively relate to one attribute negatively relate to all attributes. This suggests that leader, visionary, and innovator are perceived to relate in similar ways to brands and respondents tend to rate brands similarly across these three dimensions.

4.4 RATINGS SCALE CORRELATIONS WITH IMAGE ATTRIBUTES

To understand the consistency of measurement across the research, image utility score correlations to the attribute ratings scales were related back to choices made in the image-attribute association study. Understanding if a relationship can be built from attribute ratings for the images, through association of the images to brands, to a ratings scale evaluation of the brands is an all-encompassing evaluation of the method and the similarities among the various approaches. Although ratings scales often have different response consequences (Brown, 2015), finding a measurement of consistency helps validate the approach's usefulness as a replacement for common methods.

The correlation between percent chosen for each of the attributes and the individual respondent-level image correlations to the ratings scales is 0.66 for visionary, 0.50 for innovator, and 0.20 for leader. The correlation to the aggregate brand-level images correlations is 0.59 for visionary, 0.49 for innovator, and 0.23 for leader. Again, relationship is stronger for visionary and innovator than it is for leader. This is partially explained by the lack of strong leader images in the available set. Generally, this provides evidence for a reliability of measurement across the data explored in this study for visionary and innovator, but not as clear evidence for leader.

Chapter 5

Conclusion

This paper details several ways of interpreting brand image through association with culturally relevant images. Overall, meaningful insights on brand image can be uncovered through this process. It is not simply that brands with similar business models and overlapping industries relate in the same way to images and have the strongest relationships with images that feature their product or service. As illustrated by the relationship of the brand pairs Microsoft-Apple and Amazon-Walmart, brands that are similar in industry can have very different brand image and perceived associations.

The strength of attribute association with the evaluated images has a large impact on the ability to understand brands on that attribute dimension. This research included images with a much stronger association with visionary and innovator attributes than leader, and therefore stronger relationships to brands can be observed on those dimensions.

While this work is still preliminary and not instructing a particular strict methodology, it is necessary evidence that a connection can be made from descriptive characteristics to images to brand perception to brand ratings and qualities. This paper also illustrates the value of using choice experiments, that provides item weights, to get the most impact from a survey with time constraints and avoid the issues associated with traditional market research rating scales. While using brand pairs is not necessary for this type of research, perceived similarities and dissimilarities of brands can be analyzed.

Chapter 6

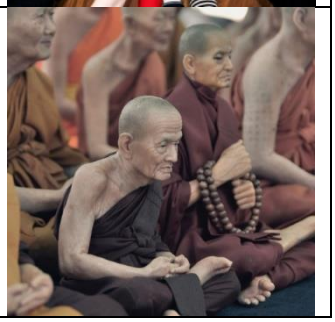
Future Research

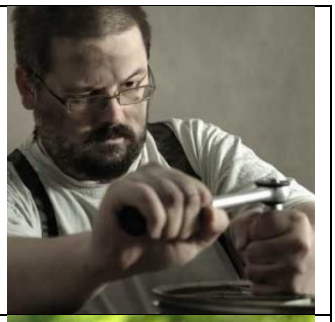
Building on the work described in this paper, I am moving forward with exploring improvements to the methodology. StrateSci Inc. is working on study brands using paired comparisons to see if brands can be further polarized with a simpler exercise. More images are being tested and introduced to the study to expand the library of useful images and remove images that do not have strong attribute associations. More brands are being evaluated, so brand-aggregate level analysis can provide stronger statistical power. This work shows evidence that there is a connection between culturally relevant images, attributable descriptive characteristics, and brand evaluations. I am refining and expanding the study design to provide stronger and more impactful evaluations and exploring evaluations of non-brand subjects.

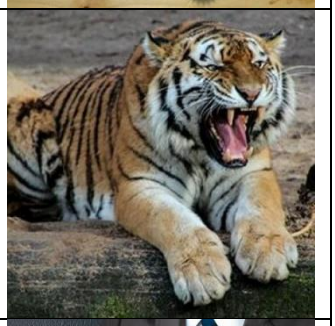
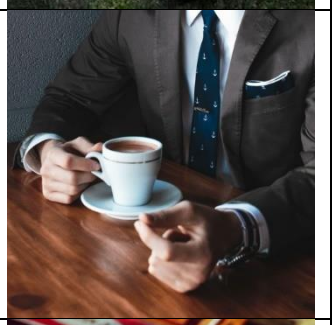
Chapter 7

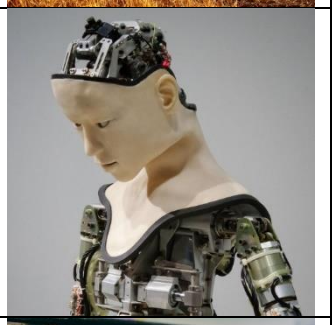
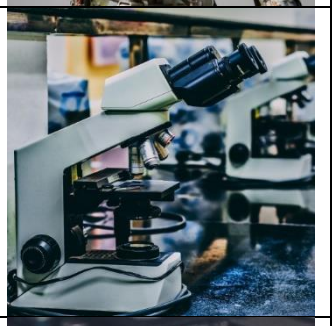
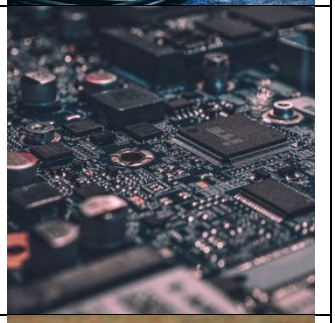
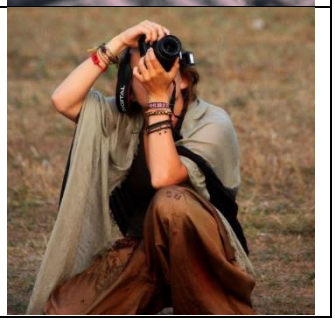
Appendix

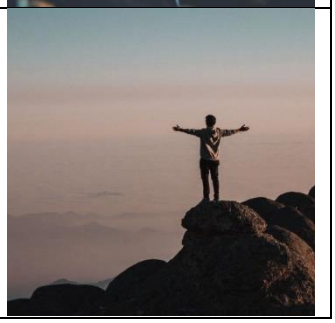
Table 7.1: Image Appendix

Index	Name	Images
1	Hiker	
2	Hands	
3	Monk	

4	Craftsman	
5	Magician	
6	Solider Helmet	
7	Modern Soldiers	
8	Computer Components	

9	Scientists Studying	
10	Craft Tools	
11	Tiger	
12	Businessman Coffee	
13	Street Merchandise	

14	Wheat Mill	
15	Robot	
16	Microscope	
17	Computer Motherboard	
18	Photographer	

19	Lightbulb	
20	Mountain Top	

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