Color and Brand Personality Traits

Measuring Associations Using Pathfinder Associative Networks

by

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ABSTRACT

Color as a communication medium plays an important role in conveying meaning. It has been identified as a major element in marketing and advertising, and has shown to influence consumer's emotions (Labrecque & Milne, 2012). Despite the large volume of color-centered research, the literature on the subject remains largely abstract and unreliable. Academic research on the impact of color on brand personality it is still in its early stages of investigation, and therefore fragmented and inadequate. The goal of this study is to identify and visually represent patterns of association between colors and specific brand personality traits. We hypothesized that such patterns exist, although the exact associations are difficult to predict. If such patterns are found, they can assist in creating a valuable design tool with wide range of applications in product design, manufacturing, and marketing.
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CHAPTER 1
INTRODUCTION

Colors are rich in symbolism, and can trigger emotions, associations, feelings, and memories (Elliot & Maier, 2007). They are often identified as soothing, exciting, passionate, controlling, playful, joyful, sad, or healing (Soldat, Sinclair & Mark, 1997). They affect perceptions, beliefs, and moods, and are a powerful tool in nonverbal communication. A growing body of research shows that some colors have stimulating properties and can increase performance, brain stimulation, and speed up the healing process, where other colors can trigger depression, fatigue, and stress (Eliot & Maier, 2007). Colors are important not only because of their aesthetic qualities, but also because they convey meaning. They play an important role in object recognition, and categorization of stimuli as negative or positive (Sutton & Altarriba, 2016).

Although color is one of the most researched subjects (Elliot, 2015), there is negligible conclusive evidence to explain why it has such huge influence. It has captivated scientists for ages (Gage, 1995), who theorized that color affects our psychological functioning (Elliott et al. 2007). Despite the vast interest, most of the information is still speculative and anecdotal, and has little empirical support. The lack of conclusive scientific explanation for the effect of colors on consumers’ emotions can be partially explained by inconsistent and diverse personal preferences, cultural and socio-economic differences, and even a person’s current mood (Whitfield & Wiltshire, 1990).
CHAPTER 2
BACKGROUND LITERATURE

Physics Perspective on Color

Scientist have been intrigued by the nature of color for many centuries (Sloan, 1991). In ancient Greece, Aristotle developed the first known theory of color (Gage, 1995). He linked colors to the four “elements”: earth, fire, wind, and water. In 1666, Isaac Newton was the first to observe the composition of a white light using two prisms. He called the visible range of colors a spectrum, and recognized that refracting, or bending the light, is what produces the colors. Color is defined as a characteristic of perception composed of chromatic and achromatic fragments. This chromatic or achromatic quality can be described by color names (red, yellow, green), or by achromatic terms (white, black, gray), and can be defined as light, bright, dark, etc. (Fairchild, 2013). In physical science, color is interpreted in terms of hue, value, and saturation (Crozier, 1999; Fairchild, 2013).

These three qualities of color play an important role in color perception. Hue is defined by the wavelength of the visible light, or what we know as blue, yellow, or green (Fairchild, 2013). The human eye can process a small fraction of the electromagnetic spectrum, ranging between 370nm and 760nm. Red, yellow, and blue are known as primary hues, because they cannot be created by mixing other colors/hues. Secondary hues are achieved by combining primary hues. These hues are violet, orange and green.
Saturation/Chroma is described as the intensity and the purity of the color. At 100% of saturation, the hues are most vivid and concentrated (Fairchild, 2013).

Value/Lightness is a feature of the color that represents how dark or light is the hue. Value is theoretically defined as the differentiable brightness of an object in relation to a perfect white item such as sheet of paper (Kueheni, 2012).

**Evolutionary Perspective on Color**

The variety of plant and animal colors indicate how important chromatic properties are for their survival (Endler, 1991; DeValois & Kooi, 1993). Coloration enables easy differentiation between species, sexes, ages, and often signal intentions. Some species use color as a defense mechanism, to protect themselves against predators. Pinna and Reeves (2015) argue that color improves the natural fitness, and therefore the opportunity for reproduction of certain genotype, allowing genes to be passed to the next generation.

People often associate colors with emotions. Red is linked with anger or passion; blue with calm; yellow with joy, etc. Humphrey (1976) suggested that colors emit signals. An “approach” signal is produced by the color of flowers to attract insects for pollination. An “avoid” signal is sent by a poisonous frog to prevent a predator attack. These signals are deeply ingrained in human reactions; they have become almost a reflex. In the modern world, colors no longer have the same signal value necessary for survival, but those natural color signals are so deeply ingrained, that they continue to shape color
preferences. Hurlbert and Ling (2007) have found support for Humphrey’s evolutionary/behaviorally adaptive theory. They argue that the color preferences are embedded in the human visual system as a neural response, which stems from evolutionary selection. In other words, the need for behaviorally important tasks such as differentiating between the redness of berries or fruit against the green background of the leaves has evolved into a preference for these colors, separately from their original context.

In the same line of research, Palmer and Schloss (2010) propose the Ecological Valence Theory (EVT), explaining the like or dislike of specific colors with environmental objects with which they are associated. The rationale behind this theory is that organisms have evolved to show preference for colors of objects that are beneficial, as opposed to those harmful for them. For example, brown and dark yellow are generally disliked because of their associations with feces, where reds are preferred due to their associations with ripe, edible fruits. EVT is critical for this study for its emphasis on the existing of color preferences based on desirable traits.

Philosophy’s Perspective on Color

Color science is a thriving field for research, with a long list of famous contributors such as Helmholtz, Hering, Goethe, and Young (Kaufman, 1974). With the support from a long list of theories, philosophy attempts to explain the impact of color on our daily lives. Colors play an important role in studying the relation between
appearance and reality. They are a key element in the attempt to understand the extent to which the perceived world is an accurate representation of the exact world.

In philosophy, colors are viewed as a “cluster concept” or a set of beliefs, emotions, and relations (Mound, 2012). Among the large number of color theories, two stand out as the most prominent - color realism, and color factionalism or non-relational theory. Color realism proposes that colors are actual physical characteristics of objects, and do not depend on human perception to exist (Johnston, 1997). An opposite opinion is expressed in the non-relational theory, which suggests that color is an intrinsic property of objects. It is a product of complex, intertwined factors such as the physical properties of light, human color vision, culture, linguistics, etc. (Cohen, 2004; Byrne & Hilbert, 2000).

The most important philosophical theory for this study is Internal Relations Theory. Relations are essential for any construct and provide context for the objects. Colors are related to other colors as members of the color array. The perception of individual colors depends on the relation they have with other colors, such as the relation of orange to red and yellow. The particular relation that orange bears to red and other colors make it exactly what it is perceived to be. If the ability to be compared in relation to other colors is impossible, orange will be no longer the color it is (Rubinstein, 2017). The concept of each color is only relevant when it is presented in the context of the whole color array, and by the relational place it holds in it. As orange is between red and yellow, so is green between yellow and blue. This "betweenness" represents the meaning
of the color. These betweenness relationships can be modeled, and help us understand the logical structure of the color array (Rubinstein, 2017). The Internal Relations theory is important for the study because it provides support for the existing associations between colors.

Psychology’s Perspective on Color

Color is a pervasive quality of the environment. It serves many purposes in addition to signaling such as facilitation of perceptual organization and differentiation between objects (Goldstein, 2010). To perceive, homo sapiens rely on a complex visual system where light enters the eye and stimulates the receptors in the retina to form a colored image. From there, the information is transferred through the optic nerve to the brain where the information is interpreted and a perception is formed.

Psychology construes colors in terms of reds, yellows, greens, etc. Following Newton’s idea that colors represent different wavelengths in reflected light and are not actual physical properties of the objects, psychologists have been trying to understand the mechanism of color perception. Two theories of color vision provide interesting perspectives on the issue.

Young and Helmholtz proposed the trichromatic theory of color vision. Based on a procedure called “color matching” they stated that color vision is contingent upon three receptor mechanisms (Goldstein, 2010). Each of the three receptors is sensitive to a
wavelength from the visual spectrum. Light stimulates the receptors to different degree, creating a pattern resulting in color perception.

While the trichromatic theory provides a sufficient explanation about some visual experiences, there are phenomena that remain unexplained. An insight to these observations was offered by Ewald Hering, who suggested that color vision is produced by opposing reactions triggered by blue and yellow, and red and green (Goldstein, 2010). Known as the opponent-process theory, it suggests that color receptors are linked to form opposite pairs. Blue is linked to yellow and green is linked to red. The activation of one receptor inhibits the other, explaining why color combinations between pairs are never observed.

Visual information is transferred from the retina to the visual cortex, and shapes and colors are perceived. But perception alone is not enough for object recognition. There have been two distinguished methods for information processing: “top-down” and “bottom up” (Anderson, 2015). In the bottom-up process, perception starts at the receptor, and is context independent, where top-down processing relies on previous knowledge and on contextual information for recognition (Goldstein, 2011). The contextual information is retrieved from the portion of long-term memory, referred to as semantic memory.

Goldstein refers to semantic memory as explicit, or memory for facts. Semantic memory contains concepts that are common knowledge, such as names of colors, names of continents, or basic information learned over prolonged periods of time. Quillian
(1967, 1969), proposed a theoretical organization of semantic memory, and the knowledge associated with it, in semantic networks. These networks are ordered by hierarchy, and consist of nodes and links (Collins & Quillian, 1969). In the network organization, each node has specific semantic properties, and is connected to other closely related concepts by links. This theory explains the close associations between words. This model was further refined by Collins and Loftus (1975).

**Marketing’s Perspective on Color**

In recent years, with the emergence of marketing as a central force in investigating and understanding consumer behavior, the focus on color as a method of communication has increased significantly. Companies such as Apple, Dell, and GE are stepping away from the traditional white/black/gray color scheme, and are offering a wide range of product color options. (Labrecque, Patrick, & Milne, 2013). Challenging the idea that color serves a mostly functional role, marketing is successfully using color as a tool for persuasion, and to attract attention (Schindler, 1986). As Labrecque et al. (2013) stated, color becomes a critical factor of every brand's visual equity, and adds to brand recognition due to the intrinsic meaning it carries. Marketing relies on that meaning as an effective persuasion strategy. As a concept, referential meaning represents the semantic network, created by associations between stimuli, such as colors, and idea or emotion. The pairing of colors with particularly salient concepts and experiences can create powerful links in the form of associations. Human actions are easily influenced by
these color associations, and subsequent behaviors such as preference and choice can be shaped (Labrecque et al. 2013).
Brand Personality

The idea of an implied parallel between human characteristics and their brand equivalent is a fundamental part of marketing, known as brand personality. According to Levy (1959), brand personality is a concept exploring the symbolic aspect of products. It is formally defined as “the set of human characteristics associated with a brand” (Aaker, 1997). Brand personality is known to impact consumer choice (Biel, 1993), transform user experience (Aaker, 1992), and create brand loyalty and trust (Fournier, 1998). It has the power to change consumer perceptions, drive market demand, and impact purchase intentions (Freeling et al., 2011).

For many years, researchers in marketing and consumer psychology have dedicated time and effort to better understand and define the concept of brand personality. Additionally, the ability to accurately measure the construct has been problematic. Several different scales have been proposed (Aaker, 1992; Batra, Lehman & Singh, 1993; Carpara, Barbaranelli & Guido, 2001), but two general approaches have been used when measuring the effect of human and brand personality traits and how they affect the consumer preferences.

The first approach applied an *ad hoc* procedure, in which different scales are used for each study. The weakness of this approach is that the scales derived are typically created for a specific product and brand, and therefore not generalizable to all brands and products. The second scale is more theoretical in nature, and is based on human personality scales. Several studies have determined that personality may be a realistic
way to express the idea of brand images (Carpara et al., 2001). Therefore, the available
Big Five Model (Cattell, 1943) of human personality seems to provide a solid structure
for classification and organization of the brand personality traits. The Big Five
personality traits systematically organized human characteristics in five dimensions of
agreeableness, conscientiousness, emotional stability, extroversion, and openness.
However, human personalities do not completely correspond to brand
personalities; therefore, the proposed scale lacks reliability and validity (Aaker,
1997; Carpara et al., 2001).

An effective method to overcome the impediments of the existing scales was
proposed by Aaker (1997). Her framework described and measured personality of the
brands using five core dimensions: sincerity, sophistication, excitement, competence, and
ruggedness. These five core dimensions were extracted through a series of trials. Aaker
began by creating a list with 309 brand personality traits, which were further reduced to
114 nonrepetitive traits. Next, in a large volume study she asked participants to rate
brands based on the 114 traits. Applying exploratory factor analysis, she was able to
narrow down further the terms to 15 brand personality facets, which were representing
consistently and precisely the five core dimensions.

Brand Associations

According to Aaker (1991) brand associations are the ideas, preferences, and
emotions connected to a brand. They are an important factor in forming the ideal brand
image because they increase product value. Tybout, Calder and Sternthal (1981) suggest
that brand associations speed retrieval and the processing of information, as well as increase product attention, and intention to purchase. Brand associations can be linked to a product’s qualities, people, places, or occasions. Henderson, Iacobucci and Calder (1998) provide an example of the associations evoked by Pepsi – sweetness; Coca – Cola; Michel Jackson; and blue and red colors. These associations have been thoroughly studied applying the network approach (Henderson, Iacobucci & Calder, 1998)

**Applied Semantic Networks**

A semantic network is a visual representation of knowledge in forms of interrelated nodes and links (Sowa, 2006). As suggested by Collins and Quillan (1969), and further confirmed by Collins and Loftus (1975), consumers store facts and the related associations in the form of networks. Collins and Loftus (1975) advanced the network model by applying the spreading activation concept. It is premised on the idea that a stimulus triggers a corresponding node, which activates a network of links and interrelated nodes. Semantic networks have been successfully used to study memory organization, and specifically consumer brand associations and brand personalities (Henderson et al., 1998).

Studies in consumer behavior, consumer psychology, and marketing have successfully measured associations between brand personality and self-congruity (Branaghan & Hildebrand, 2010), brand personality and brand logo, packaging, and other factors (Batra, Lehman & Singh, 1993), but there is still no empirical evidence for associations between colors and brand personality traits. To date, a conclusive method
for representing brand personality traits and colors does not exist. Furthermore, beyond the anecdotal speculation, no adequate organization of the color-trait association has been done.

The need to accurately measure color associations raises the problem of converting them into measurable variables. Scientists have searched for accurate methods to express thoughts, feelings, and behaviors numerically. Several methods for measuring knowledge, abilities, associations, and personality traits exist, but three are the dominant in field of psychometrics.

**Cluster Analysis**

Categorization is a fundamental process in science, and separating objects into groups is a basic human conceptual necessity. Cluster analysis (Sokal & Sneath 1966; Aldenderfer & Blashfield, 1984) is a multivariate statistical approach used to identify and represent categories or clusters of concepts. It has been applied in information retrieval, categorization and segmentation of text, and computational linguistics. Further, it is a fundamental marketing tool, used in market segmentation to discover distinct groups of consumers, and use the information to develop marketing strategies (Mooi & Sarstedt, 2010).

Cluster analysis takes as input measures of relatedness, similarity, or co-occurrence, to produce homogeneous groups with high relatedness within clusters, and low relatedness between clusters. Clustering methods include: (1) hierarchical
(agglomerative and divisive); (2) interactive partitioning; (3) density-based; (5) grid – based; (6) graph theoretic (model-based).

Output of cluster analysis often includes a dendrogram – a branching diagram, showing hierarchical clustering (Aldenderfer & Blashfield, 1984). It consists of clades or branches, and leaves bound by linkages (Figure 1). Dendrograms are relatively easy to interpret, depicting how concepts belonging to the same category show an early connection, and how unrelated concepts are connected later (or further up) in the dendrogram. Although cluster analysis provides visual demonstration of the existing relations, it has more flaw than benefits. The method can sometime lack validity, because explicit instructions or guidelines for analysis do not exists (Aldenderfer & Blashfield, 1984).

Multidimensional Scaling

In 1954 Ekman described a new psychological method addressing the problem of primary dimensions of color. The method is known as similarity analysis and was created specifically to study dimensionality of experience (Ekman, 1954). This is one of the earliest applications of multidimensional scaling (MDS) methods used to study color dimensions. According to Mead (1992), MDS is a mapping technique that represents spatially the similarity between the objects in a data set, organizing it by pairs. Similar objects are placed in close proximity to each other, and those dissimilar ones are placed far apart (Kruskal, 1964; Henderson, Iacobucci & Calder, 1998). MDS is the traditionally
accepted method of analysis in marketing (Henderson et al., 1998) validated in variety of studies in cognitive psychology, consumer behavior, and branding.
Pathfinder Networks

Collins and Loftus (1975) proposed the network structure of knowledge for facts, organizing them hierarchically by associations. By spreading activation, the main term in the network is triggered, activating all sub terms according to their proximity of associations (Collins and Loftus, 1975). Branaghan et al. (2011) suggested that it is logical to adopt the same model in representing brand personality associations, as it is highly consistent with the consumer’s memory structure.

For a while the network representation of memory was not used to its full potential, because it lacked valid, empirically derived scaling methods (Cooke, Durso, & Schvaneveldt, 1986). Since that time, such methods and algorithms have been developed, allowing the construction of networks from proximity data.

One such algorithm is Pathfinder Network Analysis (Schvaneveldt, Dearholdt, & Durso, 1985). Pathfinder was originally created to assist in psychological analysis of proximity of data set (Schvaneveldt, Durso & Dearholdt, 1989; Cooke, Durso & Schvaneveldt, 1986), but has found applications in a variety of settings. It is a powerful tool that extracts underlying connectivity patterns, and represents them spatially to visualize semantic relations. Proven valuable in studies concerned with human cognition and mostly with the similarity, relatedness, and associations, Pathfinder is the tool of choice for this study.
Networks are sometimes described as graphs, in which characteristics, such as names or qualities, are associated with the nodes and links (Harary, 1969). Because Pathfinder is premised on Graph Theory, a mathematical study of structure consisting of nodes and links used to model relations and represent data organization (Schvaneveldt et al., 1989), it appears to be the most appropriate platform for exploration of the associations between colors and brand personality traits. It has been successfully used previously to measure associations and brand constructs (Branaghan et al., 2011). In addition, it has shown reliability in exploring various research areas such as task recall, learning, and memory organization (Cooke et al., 1986; Branaghan, 1990). Cooke also found that Pathfinder provides more than just a visualization of the relationship, but also conveys conceptual organization (Cooke et al., 1986).

Pathfinder generates networks using nodes to denote concepts, and links to express the relationship between each concept. The relatedness between concept/nodes is measured by assigned weight, which represents the proximity of the two concepts in the network. This weight is the numerical expression of the relatedness. The higher the weight, the closer is the association.
CHAPTER 3

STUDY 1

To investigate consumers' associations between color and brand personality traits, extract possible association patterns, and create a design tool derived from the findings, this study is utilizing Aaker’s brand personality scale (1997), assisted by Pathfinder to represent them visually in the form of networks (Schvaneveldt et al., 1985).

In this study, we used a verbal color cue as opposed to color chips and swatches, because the goal is to measure the color as construct. Visual stimuli could potentially interfere with the process of unbiased association, and increase the ambiguity of contextual meaning. Eleven colors and fifteen facets of brand personality traits are presented for rating of relatedness. The selection of colors (Appendix E) is taken from previous research in the field of color psychology (Taft, 1997). The set includes the colors representing the visible spectrum: red, orange, yellow, green, blue, and purple, as well as black, white, brown, pink, and gray. These colors are easily distinguishable, have simple and intuitive names, and are prevalent in our environment. Some of them are fundamental factors in EVT (Palmer & Schloss, 2010), and play an important role in shaping human preferences. The fifteen facets of brand personality are taken from the Aaker (1997) brand personality scale (see Figure 2).

Our goal was to explore possible patterns of association between colors and brand personality traits. It is hypothesized that such patterns exist, although the exact associations are difficult to predict. This pattern extraction was achieved by
administering an association eliciting task, containing the eleven colors and the fifteen
brand personality facets. Relatedness ratings were collected using JTarget tool
(http://interlinkinc.net/index.html). JTarget is a program that facilitates data collection by
organizing terms according to their relation and distance to a target item
(Tossell, Schvaneveldt & Branaghan, 2010). Pathfinder was used to compare individual
network similarities, and create a model of proximity between colors and brand
personality traits. This allowed for conceptualization of the observable patterns of
association, and therefore provided unique insights into the meaning assigned to color in
relation to brand personality traits. It is also hypothesized that ratings
and Pathfinder distances will be offering predictive information beyond each other.

Participants

Twenty-eight participants were recruited to participate in the study. Five were
excluded from the data set after detailed analysis of the validation study showed that
participants whose primary language was not English were providing unusable data. The
data analysis showed that 22% to 38% of the reaction times in those entries were under
500ms, indicating that the response was initiated before the choice was made. These
datasets were excluded from the data analysis. The same exclusion criteria were applied
to the initial study to achieve homogeneity of the samples. Homogeneity of the samples
is particularly important in qualitative research because it affects the ability to generalize
the results to a population. Our study could be critically affected, and the proposed
method for measuring associations can be deemed invalid if the two samples have
notable differences.
Of the remaining twenty-three participants, 6 were female (26%), and 17 were male (74%). Nineteen of them completed the study for credit toward a partial fulfillment of a research requirement. Most of the participants were between the ages of 21 and 25 (77%). The rest were between the ages of 25 and 48 (23%). Participants provided an informed consent prior to the study. Additionally, they were asked to complete a short demographic questionnaire.

**Instrumentation**

For the rating and distances phase of the study, JTarget tool and Pathfinder Associative Networks software were downloaded from a website (http://interlinkinc.net/index.html), and installed on school-approved desktop computers. Pathfinder is a modeling algorithm for proximity analysis developed by Schvaneveldt et al. (1989). It measures the distance between associated pairs, and presents it in the form of networks. Pathfinder is widely used and validated as a tool in representing complex semantic structures (Chen, 2004).

JTarget is a Java supported program for gathering associations' proximity ratings, by arranging terms according to their perceived relatedness to a targeted item; therefore, an up-to-date version of Java is required for the assessment tool. A text file with 26 terms (11 colors and 15 brand personality traits) was created and placed in a directory, along with a copy of JTarget.jar. Subjects were given written and verbal directions prior to the task, and were instructed to provide a quick but accurate response. They were told that the goal of the study was to understand and map the meaning they assign to color in relation to a brand personality trait.
Procedure

The first phase of the study took place on the Polytechnic campus of ASU. Before participants began with the actual assessment, they were asked to sign a consent form (Appendix A) and complete a short demographic questionnaire (Appendix C). After that, they received an overview of the study, expected duration, and detailed instruction for completion of the assessment (Appendix D), followed by the opening of the JTarget file, located in the previously set-up directory on each computer. Next, participants were introduced to the Color-Brand Personality Traits assessment, where they were asked to arrange 11 colors and 15 brand personality traits (Appendix E) according to their individual perceived relatedness to a single term appearing in the middle of a target-shaped figure, using the drag-and-drop function of the mouse. Participants were instructed to use the first, most rudimentary association, and refrain from long contemplation. The JTarget program presented the colors and brand personality traits in a random order, without repetition. After the assessment, the participants were asked to complete short demographic survey (Appendix C).

Analysis

Similarity ratings were used to construct a Pathfinder network by averaging all ratings. This network provides visual representation of the underlying pattern of relationships by measuring the distances between the terms. The Pathfinder network shows that some colors are closely associated to brand personality traits, and dissociated
from others. The information provided can be used to produce a tool based on the overall association patterns to help designers, manufacturers, and marketing specialists to create a perception for a product by using the color that best represent the desired trait.

Results

The results from Study I, using JTarget to measure distances and the Pathfinder algorithm to explore possible patterns of associations, have shown that such patterns exist as predicted in the hypothesis. From the Pathfinder network (Figure 3), we can see several terms that appear to be central to the network such as “imaginative,” “spirited,” and “outdoorsy.” On the other hand, terms like “honest” and “wholesome” are limited to their immediate associations and mark the end of the network. Based on the Graph-theoretic distances, colors such as blue, brown and green can also be considered central in the associative network, because their furthest link is no longer than six nodes away (Table 1). On the opposite side, colors such as gray and white have as many as 10 links of separation. Additionally, some colors are closely associated directly only with other colors, and remotely linked with brand personality traits. The same phenomenon is observed in serval brand personality traits. These brand personality trait associations clusters support Aaker’s brand facets organization as shown in Figure 3.
CHAPTER 4

STUDY II

Semantic memory is a structured record for conceptual knowledge (Collins & Quillian, 1969). It is used for reasoning; to make decisions, understand language, and problem resolution. The concepts in semantic memory are organized in a network of nodes, connected by links of associations. Because these concepts rarely occur in isolation, Collins and Loftus (1975) proposed the idea of semantic relatedness. They suggested that attributes closely related to the main concepts are stored within a short proximity of it, and therefore are activated faster. This notion elaborated further on the model of the stimulus-response association process introduced by Gordon Bower (1961). He proposed that highly associated terms would be recognized faster than non-associated ones. Additional support for the model was offered by Collins and Quillian’s sentence verification task experiment (1969), and Meyer and Schvaneveldt (1971) effects of context on sentence verification by priming. The results from these studies show that response time increases with the distance between the terms.

Study II is a validation experiment involving a phenomenological approach to explore associations between two variables: color and brand personality traits. Color is measured by presenting the lexical term corresponding to one of 11 colors to evoke an individual idea for that color. Brand personality traits are measured by their 15 facets (Figure 2), validated as an accurate representation of brand personality in number of studies (Aaker, 1995; Branaghan et al., 2011; Labrecque & Milne, 2012). To confirm the
associations of terms, in the validation study we use the time latency method. Reaction
time (RT) and response type will establish the strength of the relationships.

The time latency study measured the response time and the type of response
– positive or negative. It used an algorithm to exhaust all possible combinations of colors
and brand personality traits. It is hypothesized that the RT will be faster for closely
associated terms confirmed by a positive response (yes), slower for the weaker
associations (slow yes), followed by a slow negative response (slow no). Fast
negative responses will have similar RT to fast positive responses.

Participants

Thirty participants were recruited for the validation study. Sixteen of them were
recruited via SONA System and completed the study for a credit toward a partial
fulfillment of a research requirement. Fourteen participants were recruited via
announcement board from a convenience sample. The data from two participants was
eliminated because it was deemed inaccurate. The RT was consistently too fast for
choice reaction task, respectively 22% and 38% of the entries were under 500ms. Some
were as fast as 20ms. Of the 28 participants, 11 were female (39%) and 17 were male
(61%). Most of them were between the ages of 21 and 25 (61%) with the rest between
the ages of 30 and 55 (47%). All participants provided informed consent prior to
participation as well as completed a short demographic questionnaire.
Instrumentation

For the follow-up study, “Inquisit 5.0” software was downloaded from www.millisecond.com. Time latency was measured using the already existing Brand Association Time Task template, validated in previous studies (Till, Baack, & Waterman, 2011). The variables used in the template were substituted with the 11 colors and 15 brand personality traits from the first study. The time latency task included instructions for how to complete the task, and a short version to demonstrate the expectations (Appendix F).

Procedure

The time latency validation study measures the time needed for each participant to select an answer. RT tends to vary and can be affected by many factors. To reduce distraction and minimize data noise, the test was conducted in a controlled environment. Upon arriving, participants were asked to provide signed consent, and complete short demographic questionnaire. Next, they received a quick verbal explanation about the task, the estimate duration, and the goals of the study.

Inquisit 5.0 software was installed on all computers and the test script was already displayed on the screen (Appendix F). The script offered instructions for the task completion. The instructions were explicit, stating that a name of a color will appear on the screen for a short period of time, and will be replaced with a brand personality trait term. At the top of the screen the word “Yes” and “No” will be constantly present. Participants were asked to indicate positive or negative association pressing the “E” key for “Yes” and “I” key on the keyboard for “No” answers. Before the beginning of the
test task, everyone was instructed to respond as quickly and accurately as possible, with particular emphasis on the accuracy. Because the test involved a motor skill, practice trials were used to introduce the goal of the task. In the practice round, participants were asked to indicate the association between the terms “cow,” “rose,” “red,” “milk,” “bell,” and “spring.” The words appeared randomly, and demonstrated the expectations.

**Analysis**

Before a conclusion is drawn based on the Pathfinder networks, additional information is necessary to confirm the validity and reliability of the test. A follow-up study investigated the degree to which Aaker’s brand personality scale and Pathfinder Associative Networks were accurate in extracting the associations between the two variables. The RT data collected from the time latency test was analyzed and compared to the data from both the initial ratings and Pathfinder distances. We accomplished this in two steps.

**Step 1.** RT outliers were corrected for each participant using a procedure proposed by Fazio (1990). Specifically, reaction times two standard deviations or more above the mean were rounded down to two standard deviations above the mean. Also, responses faster than 500ms were rounded up to 500 milliseconds. The results from several RT studies show that that accurate responses in decision tasks varied between 470ms for high frequency words, and 510ms for low frequency words (Wagenmakers, Ratcliff, Gomez, & McKoon, 2008). Therefore, setting the lower RT limit at 500ms is considered adequate, and in line with previous research.
Step 2. To make the emerging data patterns more apparent, the dataset was additionally treated with Log Transformation.

Next, the data were organized into octiles according to the answer and the RT. “Yes” answers were separated in quarters arranged from fastest to slowest. This data set was followed by “No” answers organized from the slowest to the fastest.

We hypothesized that terms that are closely associated in the Pathfinder network will have faster RT than those that are far. The graph-theoretic distances in the Pathfinder network will positively correlate with RT. To confirm or refute the hypothesis, a correlation analysis was performed, seeking to establish positive relation between three variables: initial ratings, Pathfinder distances, and RT (Table 2).

**Results**

Results indicated that ratings correlated with RT \( r (163) = .379, p < .00 \), one-tailed. Ratings did not correlate with Pathfinder distances \( r (163) = .106, p >.05 \). Lastly, Pathfinder distances correlated with RT \( r (163) = .270, p < .00 \).

It is important for this study to understand if the JTarget ratings will correlate with RT while controlling for Pathfinder distances. The results (Table 3) indicated that there is a strong positive correlation between ratings and RT while controlling for Pathfinder distances, which was moderately significant \( r (162) = .250, p = .00 \).

Further inquiry indicated that Pathfinder distances correlated with RT while controlling for JTarget ratings. The results indicated that there is a strong positive correlation between Pathfinder distances and RT, while controlling for ratings, which was
significant r (162) = .366, p = .00. These findings suggest that ratings and Pathfinder distances are adding predictive information beyond each other.

To further investigate the relation between RT and Pathfinder distances the data from Pathfinder was organized in two categories -- “Close” and “Far”. The “Close” list (Table 4) included the closest traits to each color. The “Far” list (Table 5) included the furthest traits from each color. RT data for this specific pair of associations was extracted, and a paired sample t-test was conducted to compare the RT in the “Close” condition and RT in the “Far” condition. The paired samples t-test revealed (Table 6) that participants respond faster to the pairs located in close proximity on the Pathfinder network (M = 3.74, sd = 1.10), than to the pairs located far apart (M = 4.73, sd = .99) t(27) = 3.36, sd = 1.56, p = .002, CI [1.59, 0.38].

Another point of interest concerning the difference in the data collected from ASU students and the convenience pool was investigated by comparing the mean RT for both conditions. The "close" and "far" list was further separated into data from ASU students and the alternative pool. A paired samples t-test (Table 7) found no significant difference in the RT for the closely related items between the ASU (M = 3.84, sd = .97) and alternative pool (M = 3.65, sd = 1.26) conditions; t (13) = .56, p = .558. Same was found for the RT of items located far apart in the ASU (4.80, sd = 1.00) and alternative pool (M = 4.67, sd = 1.01), t (13) = .32, p = .752 (Table 8).

Different methods for investigating possible differences between the two pools is to search for a parallel between the RT between the two pools. The means for all 165 possible traits to color combinations that were calculated for both ASU and the
alternative conditions. The test found that there is substantial correlation between the mean RT in the two samples, confirming that they are very similar \( r (328) = 0.63, n = 330, p < .001 \). Further analysis \( t (328) = 1.09, CI [-0.09,0.30] \), shows that it is highly unlikely the similarities observed between the two samples were as a result of chance.

The goal of this study was to construct a model for color and brand personality associations. This was carried out by creating a Pathfinder network, based on the ratings of relatedness between colors and brand personality traits provided by the participants. The Pathfinder graph expressed the associations in a very clear, unambiguous way. The next study investigated the validity of the model created by Pathfinder. The way this was accomplished is by creating a follow up experiment, premised on the hypothesis that if items are located within a close proximity in the network, they will have faster reaction time, and those located far apart will have a much slower reaction time. In that study participants were asked to decide as quickly as possible if a pair of terms formed of color and brand personality trait was related or not. The results from the statistical analysis provided support, confirming that distances were correlating with reaction time, and Pathfinder model of association has is valid.
CHAPTER 5
DISCUSSION

Colors carry an intrinsic meaning and are more than just an aesthetic quality (Labercque & Milne, 2012). They are a major, indispensable part of our daily life, and have been shaped through our evolution as species. The root of color meaning and associations lies deep in the history of human beings, and has evolved to be a trusted survival mechanism (Palmer & Schloss, 2010). Colors are a major part of brand identity, accentuating perceived product characteristics such as personality traits. There is a large volume of literature centered on the effects of color on human psychological functioning, but most of it is speculative, and has little empirical value (Elliot et al., 2007). Because color is such a pervasive quality, yet so deeply personal, it is difficult to generalize experimental findings. Furthermore, no previous study has attempted to measure associations of color using a valid tool for knowledge and association representation. Pathfinder has been validated as a method for proximity analysis of semantic networks, but this is the first application in color studies.

This study succeeded in producing a model of colors and brand personality traits associations. The results from the follow up experiment confirmed that the Pathfinder model is valid. The possibility to measure constructs that are influenced by many different factors can bring science closer to the ability to analyze multifaceted variables.

This study has a number of potential limitations. The use of current color selection may not reflect accurately the perceived brand personality traits. Unknown factors such as current color trends, personal brand preference, and cultural and religious
influences can act as confounding variables. Color preference and associations may be unstable, and vary between genders and different age groups. Future studies can address these factors, as they are critical for the overall understanding of color, and the meaning we assign to it. To gain deeper understanding of the factors influencing color perception and association, a larger, multivariate study is recommended. Some of the variables to consider are cultural and religious affiliation, gender, age, and current style trends locally and globally.

An important element of this study was the use of JTarget and Pathfinder for the data generation and analysis. In previous marketing studies focused on colors, scientists have relied on MDS for the concept representation. Although deemed valid, Pathfinder may not be the best method for model generation or representation of the color and brand personality associations. Further inquiries and comparison between the accuracy of both MDS and Pathfinder methods in extraction of color association patterns, can establish the advantage of one over the other.

In addition, there are other possibilities for exploration to consider within Pathfinder itself. There are three different ways to create models of association, using different networks – Pathfinder, Nearest Neighbor, and Threshold. Exploring the predictive validity of each network will be an interesting question and a great research opportunity.

Undoubtedly, this study has raised more questions than it had answered. But in true scientific spirit, it went off the beaten scientific path, and studied a phenomenon that
is difficult to measure – color association. There is much in life that cannot be measured, but color is no longer one of those paradigms. And all started with “I wonder why….”
REFERENCES


STUDY TITLE: Color and Brand Personality: Measuring Associations using Pathfinder Associative Networks

I am a graduate student under the direction of Professor Dr. Russell Branaghan in the Department of Human Systems Engineering at Ira. A. Fulton School of Engineering, Arizona State University. I am conducting a research study to as part of my thesis. I am inviting your participation, which will involve 1 hour of color and brand personality associations assessment, using an interactive tool (target). You will be given a list of terms which you will need to arrange by the proximity of association using drag and drop function. You have the right not to answer any question, and to stop participation at any time.

Your participation in this study is voluntary, and you should be 18 years of age or older to participate. If you choose not to participate or to withdraw from the study at any time, there will be no penalty. A total of 1 credits will be earned for participation.

Although there are no direct benefits from the study to individuals, participants will be exposed to the methods involved in research that may be beneficial for their own projects in the near future. There are no foreseeable risks or discomforts to your participation.

Your responses will be completely confidential. The results of this study may be used in reports, presentations, or publications but your name will not be used.

If you have any questions concerning the research study, please contact the research team: Dr. Russell Branaghan at: Russel.Branaghan@asu.edu, and Maya Toteva at Maya.Toteva@asu.edu. 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. Please let me know if you wish to be part of the study.

NAME: 

DATE: 

SIGNATURE:
### Protocol Title

Color and Brand Personality Traits: Measuring Associations using Pathfinder Associative Networks

### 2. Background and Objectives

Provide the scientific or scholarly background for, rationale for, and significance of the research based on the existing literature and how will it add to existing knowledge.

- Describe the purpose of the study.
- Describe any relevant preliminary data or case studies.
- Describe any past studies that are in conjunction to this study.

The purpose of this study is to investigate the associations of color to Brand Personality Traits, and create a model of association using the Pathfinder Algorithm. The colors selected for the associative task are Red, Orange, Yellow, Green, Blue, Purple, Pink, White, Gray, Brown, and Black. These colors were selected based on prior studies conducted on the subject of color meaning and preferences (Croizer, 1996), which were later expanded by Madden and his team of researchers (2000). The 15 brand personality traits used were developed by Aaker (1997) to best represent the dimensions of the Big Five Model. They are: Down to Earth, Honest, Wholesome, Cheerful, Daring, Spirited, Imaginative, Up to Date, Reliable, Intelligent, Successful, Upper Class, Charming, Outdoorsy, and Tough. The goal of JTarget assessment is to construct the proximity of associations between individual colors, individual brand personally traits, and brand personality traits. The results will be imported and analyzed using the Pathfinder algorithm. The Pathfinder algorithm will create a model of the networks representing the semantic relationships. The outcomes will be potentially beneficial in the field of marketing and manufacturing by providing systematically organized information about the color-trait association to achieve the desired product image.
Describe how the data will be used. Examples include:

- Dissertation, Thesis, Undergraduate honors project
- Publication/journal article, conferences/presentations
- Results released to agency or organization
- Results released to participants/parents
- Results released to employer or school
- Other (describe)

Data will be used for Graduate Thesis

4. Inclusion and Exclusion Criteria

Describe the criteria that define who will be included or excluded in your final study sample. If you are conducting data analysis only describe what is included in the dataset you propose to use.

Indicate specifically whether you will target or exclude each of the following special populations:

- Minors (individuals who are under the age of 18)
- Adults who are unable to consent
- Pregnant women
- Prisoners
- Native Americans
- Undocumented individuals

The study will be open to all consenting adults ages 18 and older. Due to the nature of the study, people with uncorrected visual impairments will be excluded. Because all materials will be presented in English, individuals lacking minimum comprehension of English language, therefore unable to freely associate terms will not be included in this study.

5. Number of Participants

Indicate the total number of participants to be recruited and enrolled: 100

6. Recruitment Methods

- Describe who will be doing the recruitment of participants.
- Describe when, where, and how potential participants will be identified and recruited.
• Describe and attach materials that will be used to recruit participants (attach documents or recruitment script with the application).

Experimenter is will not be involved directly in the recruiting process. All subjects will be recruited thru ASU polytechnic subject pool drown from HSE 101 student, using SONA system to handle the recruitment.

7. Procedures Involved

Describe all research procedures being performed, who will facilitate the procedures, and when they will be performed. Describe procedures including:

• The duration of time participants will spend in each research activity.
• The period or span of time for the collection of data, and any long term follow up.
• Surveys or questionnaires that will be administered (Attach all surveys, interview questions, scripts, data collection forms, and instructions for participants to the online application).
• Interventions and sessions (Attach supplemental materials to the online application).
• Lab procedures and tests and related instructions to participants.
• Video or audio recordings of participants.
• Previously collected data sets that will be analyzed and identify the data source (Attach data use agreement(s) to the online application).

The assessment will be a single 60-minute-long session. Participants will be provided with a schedule with available time slots at the time of recruitment. The study will be done in person at Santa Caterina Rm #155, where the Pathfinder tools is readily available on all PC’s. Each participant will be asked to sign a consent form and will be given written and verbal instructions (included with the submission), and directed to a computer where the study session will be conducted. After launching Pathfinder, participants will begin the assessment.

8. Compensation or Credit

• Describe the amount and timing of any compensation or credit to participants.
• Identify the source of the funds to compensate participants
• Justify that the amount given to participants is reasonable.
• If participants are receiving course credit for participating in research, alternative assignments need to be put in place to avoid coercion.

This study is not funded by any grants and will use students enrolled in HSE 101 for the pool. All students will receive 1 course credits for their participation.

9. Risk to Participants
List the reasonably foreseeable risks, discomforts, or inconveniences related to participation in the research. Consider physical, psychological, social, legal, and economic risks.

No known physical, psychological, social, legal or economic risks have been associated with this study.

### 10. Potential Benefits to Participants

Realistically describe the potential benefits that individual participants may experience from taking part in the research. Indicate if there is no direct benefit. Do not include benefits to society or others.

Participants will gain experience with psychological research which will strengthen the concepts they are learning about in class.

### 11. Privacy and Confidentiality

Describe the steps that will be taken to protect subjects’ privacy interests. “Privacy interest” refers to a person’s desire to place limits on with whom they interact or to whom they provide personal information. Click here for additional guidance on ASU Data Storage Guidelines.

Describe the following measures to ensure the confidentiality of data:

- Who will have access to the data?
- Where and how data will be stored (e.g. ASU secure server, ASU cloud storage, filing cabinets, etc.)?
- How long the data will be stored?
- Describe the steps that will be taken to secure the data during storage, use, and transmission. (e.g., training, authorization of access, password protection, encryption, physical controls, certificates of confidentiality, and separation of identifiers and data, etc.).
- If applicable, how will audio or video recordings will be managed and secured. Add the duration of time these recordings will be kept.
- If applicable, how will the consent, assent, and/or parental permission forms be secured. These forms should separate from the rest of the study data. Add the duration of time these forms will be kept.
- If applicable, describe how data will be linked or tracked (e.g. master list, contact list, reproducible participant ID, randomized ID, etc.).

If your study has previously collected data sets, describe who will be responsible for data security and monitoring.

Signed consent form is not required, and will not be obtained. The data from the assessment will be stored for a minimum of 5 years. Access to the information will be limited to Dr. Branaghan, Maya Toteva, and Tylor Kraus. Additional study team members will be added to the study via modification once identified on as needed basis. Computers have been password protected according to ASU standard and stored data will be password protected as well.
12. **Consent Process**

Describe the process and procedures you will use to obtain consent. Include a description of:

- Who will be responsible for consenting participants?
- Where will the consent process take place?
- How will consent be obtained?
- If participants who do not speak English will be enrolled, describe the process to ensure that the oral and/or written information provided to those participants will be in that language. Indicate the language that will be used by those obtaining consent. Translated consent forms should be submitted after the English is approved.

Maya Toteva and Tylor Kraus will be tasked with obtaining verbal consent from participants at the time of the assessment in Santa Catalina, room 155. No signed consent will be necessary. Non-English speaking individuals will not be enrolled in the study because they cannot adequately provide consent.

13. **Training**

Provide the date(s) the members of the research team have completed the CITI training for human participants. This training must be taken within the last 4 years. Additional information can be found at: [Training](#).

Russell Branaghan – ID 1011947, 10/2015

Maya Toteva - ID 18817234, 02/2015

Tylor Kraus – ID 4376887, 09/2014
IRB Form Validation Study

Instructions and Notes:

- Depending on the nature of what you are doing, some sections may not be applicable to your research. If so, mark as “NA”.
- When you write a protocol, keep an electronic copy. You will need a copy if it is necessary to make changes.

<table>
<thead>
<tr>
<th>1. Protocol Title</th>
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<tr>
<td>Semantic Decision Task - Validation Study</td>
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<th>2. Background and Objectives</th>
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<td>Provide the scientific or scholarly background for, rationale for, and significance of the research based on the existing literature and how will it add to existing knowledge.</td>
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- Describe the purpose of the study.
- Describe any relevant preliminary data or case studies.
- Describe any past studies that are in conjunction to this study.

This is a follow-up/validation study. The purpose of that study is to confirm the associations of color to Brand Personality Traits using a form of lexical decision task known as semantic decision task. Semantic memory is often described as a network of information organized by concept nodes and links connecting them. The networks are built through learning and associating new concepts with other, already existing ones (Collins and Loftus, 1975). According to the Spreading Activation Theory (Collins and Loftus, 1975) when a word is presented, it spreads automatically to the connecting nodes of semantically associated neighbors. To establish semantic relation, a priming word is presented first for short instance (400ms), followed by a mask, usually some form of symbols, for 2 sec. After that, two words are presented, one is the targeted word and the second is irrelevant to the prime word. The final task is to decide which word is related. Response time and accuracy determine the if there is a relation between the terms.

<table>
<thead>
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<th>3. Data Use</th>
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<td>Describe how the data will be used.</td>
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<td>Examples include:</td>
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</table>

- Dissertation, Thesis, Undergraduate honors project
- Results released to participants/parents
- Results released to employer or school
• Publication/journal article, conferences/presentations
• Results released to agency or organization

Data will be used for Graduate Thesis

4. Inclusion and Exclusion Criteria

Describe the criteria that define who will be included or excluded in your final study sample. If you are conducting data analysis only describe what is included in the dataset you propose to use.

Indicate specifically whether you will target or exclude each of the following special populations:

• Minors (individuals who are under the age of 18)
• Adults who are unable to consent
• Pregnant women
• Prisoners
• Native Americans
• Undocumented individuals

The study will be open to all consenting adults ages 18 and older. Due to the nature of the study, people with uncorrected visual impairments will be excluded. Because all materials will be presented in English, individuals lacking minimum comprehension of English language, therefore unable to freely associate terms will not be included in this study.

5. Number of Participants

Indicate the total number of participants to be recruited and enrolled: 40

6. Recruitment Methods

• Describe who will be doing the recruitment of participants.
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• Describe and attach materials that will be used to recruit participants (attach documents or recruitment script with the application).
Experimenters will not be involved directly in the recruiting process. All subjects will be recruited thru ASU polytechnic subject pool drawn from HSE 101 student, using SONA system to handle the recruitment.

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- Lab procedures and tests and related instructions to participants.
- Video or audio recordings of participants.
- Previously collected data sets that will be analyzed and identify the data source (Attach data use agreement(s) to the online application).

In a semantic decision task, participants perform semantic judgment of a target word. For example, participants may be asked to indicate the semantic category of the target e.g., —vegetable or color? If the priming object and the targeted word are semantically related, the participants will be able to provide the correct answer faster. The assessment will be a single 30-minute-long session. Participants will be provided with a schedule with available time slots at the time of recruitment. The data collected though semantic decision task is a reaction time and accuracy. All data will be collected and accessed through the Inquisit platform. Additionally, a short demographic questionnaire will be collected before commencing the task. The study will be done in person at CoBALT Lab, where the “Inquisit” is readily available on all PC’s. Each participant will be asked to sign a consent form, and will be given instructions. After that they will be directed to a computer where the study session will be conducted. After launching Inquisit, participants will begin the assessment.

### 8. Compensation or Credit

- Describe the amount and timing of any compensation or credit to participants.
- Identify the source of the funds to compensate participants.
- Justify that the amount given to participants is reasonable.
- If participants are receiving course credit for participating in research, alternative assignments need to be put in place to avoid coercion.

This study is not funded by any grants and will use students enrolled in HSE 101 for the pool. All students will receive .5 course credits for their participation.
### 9. Risk to Participants

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Realistically describe the potential benefits that individual participants may experience from taking part in the research. Indicate if there is no direct benefit. Do not include benefits to society or others.

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- Who will have access to the data?
- Where and how data will be stored (e.g. ASU secure server, ASU cloud storage, filing cabinets, etc.)?
- How long the data will be stored?
- Describe the steps that will be taken to secure the data during storage, use, and transmission. (e.g., training, authorization of access, password protection, encryption, physical controls, certificates of confidentiality, and separation of identifiers and data, etc.).
- If applicable, how will audio or video recordings will be managed and secured. Add the duration of time these recordings will be kept.
- If applicable, how will the consent, assent, and/or parental permission forms be secured. These forms should separate from the rest of the study data. Add the duration of time these forms will be kept.
- If applicable, describe how data will be linked or tracked (e.g. master list, contact list, reproducible participant ID, randomized ID, etc.).

If your study has previously collected data sets, describe who will be responsible for data security and monitoring.

The data from the assessment will be stored for a minimum of 5 years. Access to the information will be limited to Dr. Branaghan and Maya Toteva. Additional study team members will be added to the study via modification once identified on as needed basis. Computers have been
password protected according to ASU standard and stored data will be password protected as well.

### 12. Consent Process

Describe the process and procedures process you will use to obtain consent. Include a description of:

- Who will be responsible for consenting participants?
- Where will the consent process take place?
- How will consent be obtained?
- If participants who do not speak English will be enrolled, describe the process to ensure that the oral and/or written information provided to those participants will be in that language. Indicate the language that will be used by those obtaining consent. Translated consent forms should be submitted after the English is approved.

Maya Toteva will be tasked with obtaining consent from participants at the time of the assessment in CoBALT Lab. Non-English speaking individuals will not be enrolled in the study because they cannot adequately provide consent.

### 13. Training

Provide the date(s) the members of the research team have completed the CITI training for human participants. This training must be taken within the last 4 years. Additional information can be found at: [Training](#).

Russell Branaghan – ID 1011947, 10/2015

Maya Toteva - ID 18817234, 02/2015
Demographic Questionnaire
Color – Brand Personality Association

Q1 What is your gender?
- Female
- Male

Q2 What is your age?
- 18 - 24
- 25 - 34
- 35 - 44
- 45 – 65

Q3 Ethnicity origin (or Race): Please specify your ethnicity
- White
- Black or African American
- American Indian or Alaska Native
- Native Hawaiian or Pacific Islander
- Asian (Chinese)
- Asian (Indian)
- Asian (other)_________________
- Other _____________________
APPENDIX D

INSTRUCTION FOR JTARGET TASK
Instructions

1. Open the folder named J Target
2. Click on the J Target executable file – Java

3. Click OK on the pop-up box

4. On the screen you see a target-shaped image with a term in the middle. On the left hand side appears a list containing brand personality traits and colors. Please, drag and drop using the mouse, arrange the terms from the list on the left within the circles of relevance to the term in the center. Place terms highly associated in the circle immediately next to the compared term, moderately related in the intermediate circle, and somewhat related in the outer circle of the target. Terms that are not associated at all can remain on their original place.

5. USE INITIAL ASSOCIATION!!! Do not contemplate more than a few seconds. Use the first association that comes to mind.
APPENDIX E

LIST OF COLORS AND BRAND PERSONALITY TRAIT FACETS
List of Colors

1. Red
2. Orange
3. Yellow
4. Green
5. Blue
6. Purple
7. Gray
8. White
9. Pink
10. Brown
11. Black
List of Brand Personality Trait Facets

1. Down to Earth
2. Honest
3. Wholesome
4. Cheerful
5. Daring
6. Spirited
7. Imaginative
8. Up to Date
9. Reliable
10. Intelligent
11. Successful
12. Upper Class
13. Charming
14. Outdoorsy
15. Tough
YES

For a short time the name of a color (e.g. brown) will appear in white font in the middle of the screen. The color name is replaced by a different word or phrase (e.g. tough) in white font that might be associated with the color.

Press the LEFT response button (E) if you think ‘YES’ the word or phrase is associated with the color.

Press the RIGHT response button (I) if you think ‘NO’ the word or phrase is not associated with the color.

This is a timed task. It’s important that you GO AS FAST AS YOU CAN while making as few mistakes as possible. You should try to maximize both the speed AND accuracy of your response.

Press the <SPACEBAR> to start a short practice session to get familiar with the set-up.
APPENDIX G

FIGURES
Figure 1. Dendrite https://www.researchgate.net/figure/269931884_fig1_Figure-3-Spatial-similarity-clustering-Dendrogram-of-the-agglomerative-hierarchical
Figure 2. Aaker’s Brand Personality Scale Framework (Aaker, 1997)
Figure 3. Pathfinder Networks for Colors and Brand Personality Traits
### Table 1

**Pathfinder Distances**

<table>
<thead>
<tr>
<th></th>
<th>red</th>
<th>orange</th>
<th>yellow</th>
<th>green</th>
<th>blue</th>
<th>purple</th>
<th>pink</th>
<th>gray</th>
<th>white</th>
<th>black</th>
<th>brown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Down to Earth</td>
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<td>5</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Honest</td>
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<td>7</td>
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<td>3</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>9</td>
<td>10</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Wholesome</td>
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<td>6</td>
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<td>4</td>
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<td>8</td>
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<td>Cheerful</td>
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<td>3</td>
<td>4</td>
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<td>4</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Daring</td>
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<td>2</td>
<td>3</td>
<td>4</td>
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<td>3</td>
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<td>3</td>
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<td>Up to Date</td>
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<td>3</td>
<td>4</td>
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<tr>
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<td>3</td>
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Table 2

“Close” List – Traits in Close Proximity to Colors

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<tr>
<th>Colr</th>
<th>Close Trait</th>
<th>RT</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>4.7</td>
</tr>
<tr>
<td>2</td>
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<td>4.1</td>
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<td>14</td>
<td>4.6</td>
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<td>6</td>
<td>14</td>
<td>6.1</td>
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<tr>
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<td>8</td>
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<td>15</td>
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</tr>
<tr>
<td>11</td>
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Table 3
“Far” List – Traits in Close Proximity to Colors

<table>
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<th>RT</th>
</tr>
</thead>
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<td>1</td>
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<td>5.7</td>
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<td>2</td>
<td>4.6</td>
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Table 4

Correlation

**Descriptive Statistics**

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<th>N</th>
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<tbody>
<tr>
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<td>RT</td>
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**Correlations**

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
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<td>.106</td>
<td>.379**</td>
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<td>.089</td>
<td>.000</td>
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<td></td>
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<td>PFdist</td>
<td>Pearson Correlation</td>
<td>.106</td>
<td>.270**</td>
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<td></td>
<td>Sig. (1-tailed)</td>
<td>.089</td>
<td>.000</td>
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<td>.000</td>
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<td></td>
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**Note**: Correlation is significant at the 0.01 level (1-tailed).
Table 5

Partial Correlation

*Descriptive Statistics*

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*Correlations*

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<tr>
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</tbody>
</table>

*Correlations*

<table>
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<td>Correlation</td>
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</tr>
<tr>
<td></td>
<td>Significance (1-tailed)</td>
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</table>
Table 6

Paired Sample Statistics Close Far ASU/Alternative Pool

<table>
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<tr>
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<th>N</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Close</td>
<td>3.7396</td>
<td>28</td>
<td>1.10246</td>
<td>.20835</td>
<td></td>
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<tr>
<td>Pair 1 Far</td>
<td>4.7273</td>
<td>28</td>
<td>.98598</td>
<td>.18633</td>
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</tbody>
</table>

Paired Samples Test

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Std. Error</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 Close - Far</td>
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Table 7
Paired Samples Close ASU / Alternative Pool Test

**Paired Samples Statistics**

<table>
<thead>
<tr>
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<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 ASU Close</td>
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<tr>
<td>ALT Close</td>
<td>3.649336</td>
<td>1.2555574</td>
<td>.3355618</td>
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</tbody>
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**Paired Samples Test**

**Paired Differences**

<table>
<thead>
<tr>
<th>Mean</th>
<th>Std Deviation</th>
<th>Std Error Mean</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 ASU Close - ALT Close</td>
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Table 8

Paired Sample Test for ASU/Alternative Pool

Paired Samples Statistics

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<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>ASU Far</td>
<td>4.792200</td>
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<tr>
<td></td>
<td>ALT Far</td>
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Paired Samples Test

Paired Differences

<table>
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<th>Std Error Mean</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
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