THE EFFECT OF COLOR ON DECISION-MAKING IN A LEGAL SETTING

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by
Neil Garrett Jacobson
Summer 2013
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DEDICATION

I am so happy to dedicate this manuscript to my beautiful wife Eryka.
Without her unconditional support, care, love and understanding I would not have been able to accomplish this project. I would not be the man I am today without her, I truly am the luckiest man on earth. Thank you my love.
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ABSTRACT

THE EFFECT OF COLOR ON DECISION-MAKING IN A LEGAL SETTING

by

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Two hundred and fifty undergraduate students were presented a legal case perspective regarding a class action lawsuit describing the defendant positively or negatively and were accompanied by one of five stacked-bar graphs, or no graphic at all. The graphics were designed to manipulate visual features of the graph, including salience and hue. We presented learners with either an achromatic graphic, chromatic red graphic or chromatic green graphic representing the success or failure of the company. We measured learner evaluations of the company’s positive and negative characteristics, and doubt about the company’s guilt. Results indicated that there was no difference on evaluations and judgments when an achromatic graph was presented, but that both salience and hue influenced evaluations—specifically, that red lead to negative evaluations, except for when it is accompanied by a positive case perspective.
CHAPTER I

INTRODUCTION

This investigation was designed to examine the influence of a graphic and a text on the cognitive representations formed by learners when the learners make evaluations of a company’s guilt in the context of a litigation scenario. By cognitive representation, we mean the internal concept a learner constructs from the semantic and spatial elements shared between the text and graphic. Text and graphics have been found to aid in constructing cognitive representations for tasks including learning difficult concepts in science (Patrick, Carter, & Wiebe, 2005; Stroud & Schwartz, 2010), understanding complex mechanical systems (Mayer, 2001, 2003, Moreno & Mayer, 1999), and remembering trial information presented in a court of law (Park & Feigenson, 2013; Hewson & Goodman-Delahunty, 2008). However, despite the wealth of research on text and graphics in science and education (c.f. Carney & Levin, 2002; Mayer, 2005 for excellent reviews), little is known about the influence of graphics on evaluations and judgments of guilt in a legal setting. Accordingly, even less is known about the influence of specific graphic features on learners’ evaluations and judgments. After surveying the literature on the effects of graphics, we reasoned that the presence of a graphic and the manipulation of a graphic’s visual features would influence the cognitive representation a learner constructs of a company.
When referring to an evaluation, we mean the expression of an affinity or disaffinity in response to the internal concept a learner forms toward a person, place, idea or abstract concept (Ferguson & Fukukura, 2012). In a legal setting, learners must evaluate evidence and expert testimony presented by attorneys, and the presence of graphics has been found to alter these evaluations—in particular, scientific evidence (Isberner et al., 2013; Feigenson, 2006; McCabe & Castel, 2008). When brain scans, for example, are presented in conjunction with a scientific text, the article in which the text is embedded is evaluated more positively—specifically, the text is regarded as being better written; it’s title is evaluated as being a good description of the results; and, the scientific reasoning underlying the article is evaluated as making particularly good sense (McCabe & Castel, 2008). Isberner et al. (2013) found a similar positive effect for the presence of a statistical graph—that is, texts accompanied with a statistical graph were evaluated as more plausible than texts presented in the graph’s absence.

Whereas the influence of graphics on scientific texts has received considerable attention in research (c.f. Issa et al., 2011; Mason, Pluchino, Caterina Tornatora & Ariasi, 2013), little is known about the influence of statistical graphics on evaluations of the overall internal concept formed about a company in a litigation setting. Certainly, visual evidence including animations, videos, photographs and brain images have been successfully used in court (c.f Feigenson, 2010; Salerno & Bottoms, 2009). For example, Dunn, Salovey and Feigenson (2006) and Park and Feigenson (2013) provided evidence that graphics influence juror evaluations. Dunn et al. (2006) provided a diagram of a car accident and found an influence on damage awards. Park and Feigenson (2013)
demonstrated that presenting a PowerPoint including statistical graphics had a positive influence on jurors’ evaluations of a lawyer’s competence, credibility, preparation, and persuasiveness. Regarding judgments, Hewson and Goodman-Delahunty (2008) and Park and Feigenson (2013) concluded that comprehension of legal evidence including DNA sequencing techniques, and recall of statistical values in a court case, were enhanced when learners were shown a multimedia presentation, and the increased comprehension in Park and Feigenson’s (2013) study mediated learners’ judgments. More directly, Gurley and Marcus (2008) found that the presence of neuroimaging scans, compared to their absence, resulted in a greater number of learners judging the defendant innocent on the grounds of insanity.

However, while the investigations above support the contention that graphics are valuable in a court of law by influencing recall of trial information, damage awards, jurors’ characterization of an attorney, and judgments of guilt, there is no evidence as to whether a statistical graphic will influence the overall internal concept a juror forms of a company that may lead to evaluations of characteristics, culpability, guilt, and the damage awards that arise from these evaluations. Thus, in the present study, we aimed to understand these evaluations.

To explain how graphics influence evaluations and judgments of guilt, we adopt the dual process Elaboration Likelihood Model (ELM) of persuasion (Petty & Cacioppo, 1986) used by Hewson and Goodman-Delahunty (2008), Isberner et al. (2013) and Park and Feigenson (2013). The ELM proposes two routes for the processing of information, a central route, and a peripheral route. The central processing route is an effortful
cognitive process where a learner draws upon his or her prior knowledge to focus on the content in a message. The peripheral route, on the other hand, is a less effortful process where learners are influenced by the informational cues in the message context. We argue that, in this investigation, graphics provide both central and peripheral informational cues, that together influence evaluations and judgments of a company’s guilt. Central processing informational cues may be provided by the presence of a graphic displaying statistical values not stated in the accompanying text, and peripheral cues by the heuristic of increased plausibility of evidence when a graphic is presented. However, in this investigation, we make no distinction between the specific informational cues per se. Instead, we, argue that together both types of cues provide additional information learners incorporate into their internal concept of a company, and thereby influence evaluations and judgments compared to a condition where a graphic is absent.

A graphic however, is not a one-size fits all entity, but is composed of various features including; axes, titles, shapes, lines, salience and color (Kosslyn, 2006). We argue that a graph’s visual features are not benign, but in fact influence cognition (Cleveland, 1984; Hegarty, 2011; Kosslyn, 2006; Shah & Hoeffner, 2002). In this study, we investigated the unresearched question (Bornstein & Greene, 2011; Feigenson, 2010; Park & Feigenson, 2013) of whether salience of graphic content using color, influences learner evaluations and judgment of a company’s guilt in a legal setting.

We argue that salience and color in a graphic provide central and peripheral cues that influence encoding of information, and thereby alter the internal concept a learner forms (Hegarty, 2011; Kriz & Hegarty, 2007; Petty & Cacioppo, 1986). For example,
salient or distinctive features are: (a) attended to first (Jarvenpaa, 1990) (b) more readily recalled (von Resteroff, 1933, as cited in Hunt, 1995) and (c) can influence evaluations and judgments in domains including consumer choices (Sun, Bonini & Su, 2012), risk communication (Ancker, Senathirajah, Kukafka, & Starren, 2006; Severtson & Henriques, 2009; Stone et al., 2003; Stone, Yates & Parker, 1997;), and litigation (Bornstein & Greene, 2011). Therefore, we argue that content made salient in a graphic will provide a central informational cue motivating a learner to attend to and elaborate on the content during encoding, and that this differential encoding will influence evaluations and judgments of a company involved in a court case.

Salience can be achieved by manipulating many features including size, shape, and color (Hegarty, 2011; Kosslyn, 2006); however, in this investigation, we were interested in creating salience through color. Research on salience has predominately ignored the effect of using different colors to make salient the same information, but support for the influence of color exists (Moller, Elliot & Maier, 2009; Braun and Silver, 1995; Kuhbandner and Pekrun, 2013; Leonard, 1999).

In this investigation, we created salience using the colors red and green, both of which are frequently studied in color research (c.f. Elliot & Maier, 2012 for an excellent review). Whalen and Blanchard (1982) provided evidence for the function of color in litigation by investigating the effect of colored photographs on damage awards, concluding that awards were greater when color photographs were presented. In addition, recent work by Kuhbandner and Pekrun (2013), provided evidence for the influence of colors on cognition in addition to merely making information more
memorable. Specifically, they found that red enhanced memory for negative words and green enhanced memory for positive words. Red and green have also been found to influence evaluation in domains including perceived hazard (Braun & Silver, 1995; Leonard, 1999), consumer behavior (Bellizzi & Hitte, 1992), evaluation of essays and grades (Abraham, Rutchick, Slepian & Ferris, 2010), male job applicants (Maier et al., 2012), and teachers (Dukes & Albanesi, 2012), with red resulting in more negative evaluations.

Red communicates strongly negative information (Maier et al., 2012; Moller et al., 2009) compared to green, which has a weakly positive association with positive evaluation (Coursaris & Sweirenga, 2008; Crowley, 1993; Lechner & Simonoff, 2012; Valdez & Mehrabian, 1994). However, while color has received some empirical attention, color has not been manipulated in the presentation of a statistical graphic in a legal setting. Thus, we argue that hue or “color” is a “nonlexical stimulus that can communicate information quickly, subtly, and across barriers of language, age, and even species” (Moller, Elliot, & Maier, 2009). It accomplishes this communication by signaling information about the environment, giving rise to evaluative processes (Elliot & Maier, 2012). Thus, we argue that red and green function as implicit peripheral cues influencing the construction of a learner’s cognitive model, resulting in differential evaluation (Friedman & Förster, 2010).

In addition, we argue that the object on which a color is viewed will influence the evaluative response to the color (Elliot & Maier, 2012). For example, Moller et al. (2009) found that the ability to determine the valence of positive and negative words was
speeded by the words being presented in red or green, respectively. Classically conditioned associations, such as the repeated pairing of red with stop and green with go, or the convention of red representing failure and green success, indicate that colors have socially-based meanings. In line with this, Kuhbander and Pekrun (2013) concluded that red and green differentially enhance memory for negative and positive stimuli. We argue, that the violation of a color’s conditioned meaning may influence evaluations consistent with the basic evaluative responses to those colors—specifically, that red will enhance the effect of negative information compared to green. However, we have encountered no research measuring evaluation or judgments when these classically conditioned links are violated. In fact, Kosslyn (2006) states that graph designers should not violate the meanings of color.

**The Present Investigation**

In the present investigation, we were interested in whether learner’s evaluations and judgments of a company were influenced by the presence compared to the absence of an achromatic statistical graphic. For this investigation, we chose a stacked-bar graph with a 60% success to 40% failure ratio. If, as Park and Feigenson (2013) state, the presence of a graphic acts as both a central and peripheral informational cue, learners will process the display either centrally or peripherally and encode that information into their internal concept of the company.

In addition, we were concerned with salience of content in the stacked-bar graph and the specific colors used to manipulate that salience. If, as Petty and Cacioppo (1986) state, central processing can be stimulated by informational cues, we argue that salience
in the stacked-bar graph, according to Hegarty (2011), will draw attention to and motivate a learner to elaborate on the statistical content of the message. This elaboration will result in differential encoding of the statistical information into a learner’s internal concept of the company, and thereby influence evaluations and judgments. In addition, we reasoned that if the color used to create salience acts as an implicit peripheral informational cue signaling information about the evaluative context as Elliot and Maier (2012) state, evaluations and judgments of the company would be influenced. Finally, we were also interested in the intentional violation of a color’s socially conditioned meaning. In this investigation, we represented failure in green and success in red, to understand if the basic evaluative responses to a color (red-negative and green-positive) have a differential effect on evaluations and judgments when representing either success or failure.

Hypotheses

We predicted that, if a learner constructs an internal concept of a company, the presence of a statistical graphic would influence evaluations and judgments of that company. However, just as we argued that the visual features of a graphic are not benign and influence cognition, the statistical values the graph depicts are also variables to consider. As stated, we constructed a stacked-bar graph depicting a 60/40% ratio of the company’s success and failure, respectively. We chose percentages close in ratio to 50/50% to understand the influence of a graphic when the information presented is ambiguous, or not readily apparent. However, if as Park and Feigenson (2013) and Hegarty (2011) state, graphs do provide informational cues and statistical content learners
encode into their internal concept— we argue that 60% is considered “failing” and therefore hypothesize more negative evaluations of the company, and greater judgments of guilt when the graph is present compared to absent.

Despite the statistical data in the graphic, and the overall low performance of the company, if as Hegarty (2011) and Jarvenpaa (1990) state learners attend to and encode salient information into their cognitive representation, we hypothesize evaluations of the company to be more positive when success is made salient compared to failure, regardless of the color used. However, we further hypothesize that the absence of a graph will result in more positive evaluations compared to the presence of either a chromatic or achromatic graph due to the explicit depiction of failure when a graph is present. In addition, we hypothesize that learners will judge the company as more guilty when exposed to the graph making salient failure compared to success or an achromatic graph. Judgment of guilt will be lowest when the graph is absent.

In addition, if as Moller, Elliot and Maier (2009) and Kuhbander and Pekrun (2013) suggest, red carries a negative meaning compared to green, we hypothesize evaluations of the company to be more negative, and judgment of company’s guilt to be greater, when a red graph is presented compared to a graph that is green or absent, but not achromatic graphic. Although green has a positive association, we argue that it is not strong enough to alter evaluations of the company relative to the presence of statistical data in the gray graphic, or the positive evaluations that will occur when the graph is absent.

Finally, if we neglect Kosslyn’s (2006) warning regarding violating the socially-based meaning of a color, and represent success and failure with both red and green, we
predict differential effects. As previously stated, red has a strong negative link, whereas green has a weaker positive link (Moller et al., 2009). Thus, we argue that the basic evaluative response to red and green will influence the content it represents in the graph, magnifying and reducing the evaluations of the content depicted, respectively. Therefore, we hypothesize that red representing success will result in more negative evaluations of the company compared to the absence of a graphic, but that green representing success and an achromatic graph will not significantly differ from one another or the absence of a graph. Accordingly, we hypothesize a similar effect for the representation of failure—specifically, red representing failure will result in more negative evaluations of the company compared to the absence of a graphic, but that green representing success will not differ from any other graphics.
CHAPTER II

LITERATURE REVIEW

Introduction

The ability to communicate information is one of the most identifiable human qualities, and allows humans to communicate about risk, motivations, events that occurred in the past and predictions of the future and so much more. Our ability to differentially communicate this information is also a uniquely human attribute. Humans employ both verbal and visual forms of communication including spoken words, written text, diagrams, charts, graphics and animations. All of these mediums are designed to communicate information, and do so with varying degrees of success. Here I review some of the work on the mediums used to communicate information, and the frameworks by which they function both separately and together. I begin with a summary of text framing, and graphics processing research. After discussing a leading model of graph comprehension I review some of the theoretical work on specific features of visual displays including salience and color. The review then discusses text-graphics comprehension and text-graphics interactions in law, and concludes with an overview of a dual process model of persuasion.
Message Framing

Kahneman and Tversky (1979) systematically studied the process by which presenting logically equivalent information in one of two ways influences human cognition and decision-making. Through their research they developed Prospect Theory, which sought to explain how individuals made decisions when information was presented in terms of either a loss or a gain. Their seminal work centers on the Asian Disease problem (Tversky & Kahneman, 1981), where an individual is confronted with two choices, and depending on whether the message frames the potential gains or losses (number of people who die or live), a different choice is made. Specifically, that when presented with a loss frame individuals choose the risky option. However, when presented with a gain frame, individuals reverse their preference and choose the riskless option. Tversky and Kahneman (1981) explain their findings via an S-shaped subjective value function. This value function states that individuals place high value on risk (risk seeking) when presented with a loss frame and low value on risk when presented with a gain frame (risk aversion). This line of research has greatly informed how individuals weigh decisions in this context and the majority of research has supported the risk aversive choice when presented with a gain frame (Levin, Schneider & Gaeth, 1998).

However, as research into framing effects continued Levin et al. (1998) found the need to construct a taxonomy of framing effects and delineated three fundamentally distinct valence frames. In addition to the classic risky decision frame, they identified goal framing and attribute framing. As previously introduced, risky decision framing involves the presentation of a message framed in terms of gains or losses in conjunction with either a risky option or a guaranteed option. This manipulation allows for
comparison between choices made for either frame. Consistent results for this risky decision paradigm support the notion that more risky choices are preferred when individuals are exposed to a loss frame compared to a gain frame, where preference for the guaranteed option is preferred.

In addition, Levin et al. (1998) identified goal framing as an additional form of valence framing. In goal framing a communicator motivates a reader to attain a goal by framing either the potential losses of not engaging in the behavior or the possible gains of engaging in the behavior. This framing manipulation is theoretically distinct in that both messages promote seeking the goal; the difference however, is in the relative strength of either a positive or negative framing of the message on behavioral intentions. Medical researchers have embraced this method of framing because motivating individuals to engage in various health behaviors is of great importance. However, a recent meta-analysis by O’Keefe and Nan, (2012) including 32 studies on goal framing indicated no persuasive benefit for gain-framed messages compared to messages that are loss-framed. This critical analysis indicated that goal framing might influence decision-making but only for parents choosing to vaccinate their children.

Furthermore, Levin et al. (1998) described attribute framing as the, “most basic form of framing” and involves presenting logically equivalent information in one of two ways, positively or negatively. The dependent measure in attribute framing is evaluation of the target when exposed to a frame that describes the target either positively or negatively.

Consistent results regarding the effects of attribute framing have been found in various domains including; litigation, specifically damage awards and perceptions of
company ethics, (Dunegan, 1996), managerial decision-making, (Duchon & Dunegan, 1989), (Kuvaas & Selart, 2004) consumer evaluations (Putrevu, 2010), vaccine effectiveness, and support for a candidate in favor of vaccinations (Bigman, Capella & Hornik, 2010) and product perception (Levin & Gaeth, 1988; Levin, Gaeth, Schreiber & Lauriola, 2002; Levin, Schneider & Gaeth, 1998). After reviewing the literature Levin et al. (1998) concluded that no study found more positive evaluations for a negative frame compared to a positive frame.

Dunegan (1996), demonstrated a litigation framing effect in a study that framed a company as knowing 80% their advertising was deceptive or 20% not knowing. Results indicated that participants rated the company as significantly less ethical and awarded 97% higher fines to the company when exposed to a negative frame compared to a positive frame.

Duchon and Dunegan (1989) investigated the allocation of funds to a research and development team who had successfully completed 60% of their projects of failed to complete 40% of their projects. Results indicated that more money was allocated to the team when presented with a positively framed message compared to a message that was negative. In the study conducted by Levin and Gaeth (1988), a hamburger patty was described as 75% lean or 25% fat, and results indicated that evaluations were more positive for the target attributes greasy/greaseless, low quality/high quality when individuals read a frame that was positive compared to one that was negative.

In addition to evaluations, attribute-framing effects have been identified in legal decision-making. Scurich and John (2011) investigated the influence of attribute framing on actuarial risk assessment of individuals for commitment to a psychiatric facility and
concluded that a positively framed message significantly reduced the number of patients committed.

Attribute framing is thought to influence evaluations by presenting a point of view that encourages the facts of a given situation to be interpreted in a particular manner by making salient certain information, thereby influencing encoding of information congruent with the perspective of the frame (Kuypers, 2009). Entman (1993) stated that to frame, “is to select some aspects of perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, casual interpretation or moral evaluation”.

The point of view presented in the message leads to what is called a valence-consistent shift. A valence-consistent shift occurs when evaluations mirror the valence of the framed message, specifically that positive frames result in positive evaluations and negative frames in negative evaluations. This effect arises through differential encoding of information into memory. Positive attribute framing leads to valence-consistent encoding of positive information compared to negative attribute framing leading to encoding of negative information of the target. This differential encoding leads to a different cognitive representation of the framed target. These message-framing typologies have proven incredibly successful in understanding the differential effects of messages on influencing human affect, cognition and behavior.
Kriz and Hegarty’s Integrative Model of Display Comprehension

In addition to text, researchers are also interested in how learners comprehend information in a visual display or a graph. Kriz and Hegarty, (2007) and Hegarty, (2011) proposed an Integrative Model of Display Comprehension explicating the way in which an individual constructs understanding of an external representation through the interaction of bottom-up and top-down processing.

The proposed model defines graphs as, “visual-spatial arrays that represent, or are symbols for, objects, events, or more abstract information”. In addition, Hegarty (2011) proposed three distinct types of displays: iconic displays, relational displays and complex displays. An iconic display is, “a representation of objects that themselves are visual spatial entities”. One example of an iconic display is a diagram of a pulley system. Hegarty (2011), further describes a relational display as one that, “represents entities that do not have spatial extents and are not visible”, an example being a scatterplot showing the relationship between two variables. Additionally, Hegarty (2011) states that hybrid displays of iconic and relational displays exist and display, “nonvisible properties overlaid on a representation of a visual spatial entity”, an example being a map of the United States overlaid with temperature information depicted in color. Finally, Hegarty (2011) states that complex displays of iconic, relational and hybrid displays include: multiple representations, animations and display interactivity, and are a separate dimension to consider when attempting to understand visual displays.

The proposed model of graph comprehension features seven components
involved in the comprehension of visual displays: 1) the external display, 2) the visual features of the display, 3) an internal representation of the display, 4) an internal representation of the referent, 5) domain knowledge, 6) display schema, and 7) learner goals.

An external display is defined as anything that exists on a computer screen, paper or other medium that can be perceived by a learner. Visual features pertain to the external display and include size, shape and color. For example, a learner may perceive a red rectangle or a downward slanting red line. The internal representation of the display is the internal mental image a learner constructs and holds in mind about the external display. Furthermore, an internal representation of the referent is an understanding of the external display, specifically the object or objects that the display depicts. In addition, domain knowledge is the information the learner possesses about the referent itself. A learner can also possess a display schema, or experience in viewing the particular graphic format and this experience can alter internal representation construction. Finally, the learner engages with the external display relative to their goals.

The aforementioned 7 components are integrally linked by a series of functions including perception/attention, encoding, knowledge-driven processing, learning and inferences. To begin, the external display is perceived and attended to, however, encoding of the display is directed by top-down processing of display schema, goals and knowledge of the referent. This top down influence alters what information is encoded and thereby changes the internal representation a learner constructs. For example, if the learner does not attend to relevant material, the internal representation will be lacking, however, if a learner is familiar with the display format and the content
displayed, they may encode task relevant information and their internal representation
will reflect that. The process of integration also occurs at this encoding stage in that a
learner must combine separate visual features of the display in order to derive the
meaning of the entire visual display.

After an individual has attended to and encoded visual features as well as
created an internal representation of the referent, the learner can incorporate this newly
acquired information with their domain knowledge. The described processes can all be
described as learning, however; the comprehension of a learner is influenced both by the
encoding and constructing processes as well as the display itself. This described learning
process refers to the interaction between domain knowledge and an internal
representation of the referent; however, inferences can also be generated that go beyond
the information contained in the display. At this point a learners internal representation
may contain less information than what was present in the external display, but also more
information in that it is combined with a learners existing knowledge.

Visual Features

Salience

As previously explained, Kriz and Hegarty’s (2007) and Hegarty (2011) model of
graph comprehension states that the visual features (color and shape) of an external
display may influence attention directed to specific features of the display. Research on
salience has indicated that information made salient is attended to first (Jarvenpaa, 1990)
and is more readily recalled (von Resteroff, 1933 as cited in Hunt, 1995). Salience, or
distinctiveness has been found to influence evaluations and judgments in domains
including consumer choices (Sun, Bonini & Su, 2012), risk communication (Stone, Yates & Parker, 1997; Stone, et al., 2003; Ancker, Senathirajah, Kukafka, & Starren, 2006; Severtson & Henriques, 2009), and litigation (Bornstein & Greene, 2011).

Research in the domain of risk assessment has indicated that presentation of visualizations; specifically graphs with content made salient can alter decision-making. For example, Sun et al. (2012) measured satisfaction with an electronic device and manipulated an experimental graphic making salient one of two product features, reparability or capability. Their results indicated that depending on the feature made salient in the graph, evaluations were more positive for the feature made salient. Stone, et al. (1997) investigated the influence of salient graph content on the evaluation of risk and found that when the foreground (depicting the number of people harmed) was made salient relative to the background (total number of people at risk) individuals exhibited greater risk avoidance. Stone et al. (2003) replicated this earlier finding and in a second study presented a graphic with the foreground and background equally salient, which nullified the previous finding, supporting the idea of differential encoding relative to salience.

Jarvenpaa (1990) investigated the influence of graphic salience on decision-making with simulated real estate advertisements. Their results indicated that the organization of the graphic structure led to encoding of consistent information and that salient information was attended to first. Similarly, in litigation, jurors are confronted with a multitude of information to process and can be biased by representativeness or attention to salient features thereby influencing their judgments (Bornstein & Greene, 2011).
Color

Color is a ubiquitous phenomenon that for the majority of humans is taken for granted. It is ever-present and constantly signals information, whether in a graphic or about our environment, ranging from a ripe piece of fruit to understanding the facial expressions of both friend and foe. Color research has a rich history in the field of psychology dating back to research conducted in Wundt’s laboratory and has been a fruitful field of research (Whitfield & Wiltshire, 1990). The majority of the research however, has sought to explain universal meanings of color, associations with mood tones, preference, and arousal (c.f. Elliot & Maier 2012 and Whitfield & Wiltshire, 1990 for excellent reviews).

Not until the past 15 years however, has color been studied systematically, and for this reason the color psychology literature is small in that it has had to be rebuilt for several methodological issues identified by Elliot and Maier (2012) in their foundational work entitled “Color-in-Context Theory”. To begin, we present the theoretical model outlined by Elliot and Maier (2012), then define the components of color and review their empirical findings, and finally address the aforementioned methodological issues.

In their foundational work, Elliot and Maier (2012) stated that to study color a researcher must accept six premises. Firstly, that color carries meaning and does so beyond merely aesthetics. Secondly, viewing color influences human affect, cognition and behavior. Thirdly, the effects of color on psychological functioning are automatic and occur outside of conscious awareness. Fourthly, color meanings arise from two sources, biology and learning. For example, evolutionarily, red could depict a ripe fruit, an angry
male, or a fertile female; the idea is that biologically these colors represent something in the environment and we as humans respond accordingly. The second source of color meanings is that of classical conditioning, where repeated pairings of a color with an object or event leads to a pairing of stimulus and response. The fifth premise is that perception and affect have a reciprocal relationship with color effects on human affect, behavior and cognition. For example, the observer does not always interpret a color in the same way; interpretation can in fact be influenced by the affective state of the individual. Observing a color can also influence the affective state of the individual, thus showing the reciprocal relationship between color and human affect, behavior and cognition. The final premise is that color meanings and effects are context specific.

Elliot and Maier (2012), state that color has at least three dimensions including; luminance, chroma, and hue, and that each dimension of color has differential effects on human affect, behavior and cognition. Luminance of a color is similar to brightness and can be described as the amount of white or black. Chroma is similar to saturation or vividness, and hue is defined as the wavelength of a color.

For example, Meier, Robinson, and Clore (2004) conducted a study exploring the evaluation of various luminance levels. Results indicated that white was evaluated as “good” and black as a “bad”. In addition, Camgöz, Yener and Güvenc (2002) investigated luminance and concluded that individuals prefer bright colors compared to other levels of brightness across all colors. Furthermore, Valdez and Mehrabian (1994) systematically studied the influence of luminance, on pleasure, arousal and dominance via semantic differential scales. Their results indicated that brightness has a positive relationship with pleasure and arousal, and a negative relationship with dominance.
Chroma or vividness of a color has also been found to influence human affect, cognition and behavior. Valdez and Mehrabian (1994) found that chroma had a positive relationship with arousal and dominance. In addition, Camgoz et al. (2002) found that saturated hues are the most preferred on any background and attract a significant amount of attention regardless of the color.

According to Elliot and Maier (2012), the three facets of color interact to influence human affect, behavior and cognition and until recently have not been properly controlled, making interpretation of color research difficult. The primary methodological error in color research has been the lack of experimental control for the three color dimensions. As evidenced, hue is only one dimension of color and in order to study the effects of a specific hue a researcher must control the levels of luminance and chroma or to study chroma, equate hue and luminance. Elliot and Maier (2012), state that equating the luminance and chroma of colors used in studies will greatly inform the field of color research and prove most useful for building a strong theoretical foundation. The advent of accessible technology, specifically the spectrophotometer, enables color researchers to control these various dimensions of color to systematically study one specific dimension of color.

Currently, research on hue is being conducted by a small group of individuals yielding high quality theoretical and methodological work by attending to the dimensions of color and the theoretical framework outlined by Elliot and Maier (2012). Thus far the effects of red have been investigated in achievement settings (Elliot, Maier, Binser, Friedman & Pekrun, 2009; Elliot, Maier, Moller, Friedman & Meinhardt, 2007; Elliot, Payen, Brisswalter, Cury & Thayer, 2011; Lichtenfeld, Maier, Elliot & Pekrun, 2009;
Maier, Elliot & Lichtenfeld, 2008) defined as a situation in which evaluation will take
place and both success and failure are possible, sexual attraction (Elliot and Niesta,
2008), wherein individuals evaluate the perceived attractiveness of a male or female,
fostering creativity (Lichtenfeld, Elliot, Maier & Pekrun, 2012) and most recently in an
impression formation setting (Maier, et al., 2012), specifically a job application defined
as the evaluation of another’s competence, have been studied

The majority of this research has focused on the differential effects of the
color red in various contexts. When investigating achievement, consistent results
regarding the inimical effects of red have been found—specifically that learning
outcomes are significantly lower when exposed to red relative to other colors including
blue, green and gray. However, a positive effect of red has been found when studying
romantic evaluations, with results indicating that red enhances attractiveness ratings for
both males and females. In addition, in impression formation, viewing red on a
prospective male job applicant compared to either green or blue resulted in more negative
evaluations of their characteristics.

As evidenced here, there are various dimensions of color, and these
dimensions all influence human affect, cognition and behavior. In order to understand
their individual effects, researchers must be cognizant and control as many variables in
their study as possible to allow for clear interpretation of their results. In addition, the six
premises outlined by Elliot and Maier (2012) allow for color effects to be investigated in
any context, the majority of which have yet to be investigated.
Mayer’s Cognitive Theory of Multimedia Learning

Mayer (1997, 2005) proposed along with a body of empirical research the Cognitive Theory of Multimedia Learning (CTML). Mayer contends the model explains how learners make meaning from the presentation of a text and a graphic and that this meaning is enhanced when a graphic is presented with a text. The model is predicated on three assumptions 1) learners possess two channels by which information can be processed (visual and auditory) (Baddeley, 1992; Clark & Paivio, 1991), 2) learners working memory has a limited capacity (Cowan, 2001; Miller, 1956), and 3) learners are not passive but active participants in constructing understanding.

As stated, this model revolves around three assumptions of human information processing. In line with Clark and Pavio’s (1991) dual coding theory and Baddeley’s (1992) model of working memory, Mayer argues that information can enter the information processing system through both an auditory/verbal channel and a visual/pictorial channel, via either spoken or written words and pictures. A distinction exists however, between how the information exists in the processing system, Baddeley (1992) posits that encoded material is represented in a visuospatial sketchpad and a phonological loop that is sensory specific, whereas Clark and Paivio (1991) state that the code or the presented material determines how it is stored. The distinction primarily applies to on screen text, which is represented visually, but is arguably processed auditorily. However, Mayer states that a learner is able to devote cognitive resources to, and convert verbal information into auditory information and vice versa.
The second assumption Mayer makes is that, a learner is constrained by a limited working memory capacity and can therefore not perceive or encode all information present. However, the capacity of working memory is currently contested (Baddeley, 1992; Cowan, 2001). Finally, Mayer argues that a learner actively constructs a coherent cognitive representation of information and experiences. This coherent mental model is constructed via strategies including comparison, generalization, classification and enumeration. This assumption centers on the argument that learners seek to make meaning of their experiences including multimedia presentations, and do so by constructing a coherent representation.

After stating the three assumptions, Mayer proposes a sequence of three processes a learner engages in to actively construct a knowledge structure or mental model. First a learner interacts with external visual and verbal information, by selecting relevant verbal and visual information resulting in a text and image base. These text and image bases are organized in working memory into structural relations both verbally and visually. Finally, the external material structures held in working memory can be integrated or connections can be made with prior knowledge. The sum of these processes is that a learner may construct an integrated mental model of the verbal and visual information in combination with their prior knowledge resulting in understanding of a multimedia presentation.
Litigation law is a unique context in which information is taught to a group of 12 jurors or learners. These learners are asked to process and understand a multitude of case material and arguments and make decisions about the legality of individual’s actions. It is well documented however, that jurors have great difficulty in comprehending convoluted and difficult laws and case arguments and can be biased by both what is stated and shown.

Attorneys and lawyers operating under the assumption that it is beneficial to their case argument have embraced the use of visual demonstrative evidence. However, research on the influence of visual aids in litigation has just begun to understand the influence they have on jury decision-making (c.f. Feigenson, 2010 for an excellent review). In Feigenson (2010), he reviews the empirical research on photographs, video, videotaped testimony, computer animations and PowerPoint.

When discussing photographs he cited a study by Whalen and Blanchard (1982) who conducted a study on the effects of presenting a color photo, a black and white photo and no photo on damage awards. Their results indicated that learners awarded significantly higher damage awards when presented with a color photograph. Feigenson (2010), also reviewed the influence of the presentation of diagrams in litigation. He cited a study by Dunn, Salovey and Feigenson (2006) who concluded that the presentation of a computer animation depicting an accident had a significant influence on evaluations of responsibility and liability.
Surprisingly, PowerPoint use in a litigation setting has been relatively uninvestigated until Park and Feigenson (2013). This investigation tested the influence of lawyer presentation of a PowerPoint in conjunction with their opening statement on both evaluations of the lawyer and evaluations of the defendant’s responsibility. Their provocative results indicated that jurors were influenced by the presentation of a PowerPoint both directly and indirectly. Jurors were better able to recall the specific statistical values when a PowerPoint was presented and this mediated judgments of responsibility. In addition, the presence of a PowerPoint also resulted in more positive evaluations of the lawyer’s competence, preparation and credibility, also mediating judgments of the defendant’s guilt.

Graphs, although missing from Feigenson’s (2010) review of visual evidence have also been found to influence juror decision making in the legal setting. The advent of neuroimaging has allowed for the easy accompaniment of expert testimony with high quality visual aids. Learners are biased by the mere presence of a neuroimages and evaluate scientific texts as more plausible and having higher scientific merit when accompanying a text (McCabe & Castel, 2008), although conflicting research exists (Schweitzer et al. 2011). In addition, Isberner et al. (2013) found that the presence of statistical graphics influence evaluations of a scientific text through the heuristic that graphs are related to higher scientific reasoning.

This review indicates that the study of juror decision-making is influenced by the addition of demonstrative visual evidence and is an important area for future research. Although there are guidelines to the use of visual evidence, psychological research may
illuminate specific functions that these forms of evidence have on human affect, cognition and behavior.

Elaboration Likelihood Model

There is agreement in the field of psychology that learners are influenced by a persuasive message, however, the exact way in which this persuasion occurs is still being investigated. Despite the unclear mechanisms of persuasion, Petty and Cacioppo (1986) have proposed a dual process model by which individuals can be influenced by the content of persuasive message or qualities inherent to the message itself.

Petty and Cacioppo (1986) and Petty, Brînol and Priester (2008) proposed that a two process model was necessary to understand persuasion, in that learners can be both motivated or unmotivated to process information and therefore attend to the persuasive message differently. To account for this difference in motivation and accordingly processing approach and persuasion, Petty and Cacioppo (1986) proposed two routes by which a message could persuade a learner, one central and one peripheral.

The central route of persuasion is an effortful cognitive process undertaken by a learner who is motivated to engage with and process the content and arguments of the message. When engaged in central route processing a learner is attempting to determine the merits of the message and does so by accessing prior knowledge and experience to do so. During this cognitively effortful process a learner is developing favorable and unfavorable evaluations of the message in response to the arguments and content of the message itself.
An important caveat mentioned by Petty et al. (2008) is that the content of a message is interpreted relative to the learner. For example, due to a learner’s prior knowledge and experiences, certain arguments may resonate with them and be interpreted as central. In addition, the situation a learner is viewing the message in determines what arguments or information will be elaborated on and result in central processing.

After a learner engages in central route processing, the final step is to incorporate their evaluations generated of the elaborated content into their overall cognitive structure. Although the elaboration was cognitively effortful, Petty et al. (2008) state that this does not mean the attitude formed will be rational, because it may have been heavily biased by the learner’s previous knowledge or experiences. Finally, one characteristic of a centrally processed and elaborated attitude is that due to the cognitive effort expended the attitude is strong and fairly stable.

As previously stated, there are two routes to persuasion, one effortful and one requiring less effort. Whereas the central route is an effortful cognitive process, the peripheral route to persuasion is significantly less effortful. First of all, peripheral processing typically occurs when a learner is unmotivated to engage with and elaborate on the message, and therefore relies on informational cues inherent to the message context (Petty et al., 2008). Such peripheral informational cues include, heuristics such as being in a positive or happy mood, assuming that the presence of graphs is an indicator of scientific quality, or the assumption that the expert is correct. These examples of peripheral route informational cues to persuasion are not regarding the specific arguments in the message itself but instead are peripheral to the arguments and exist in the message context.
Despite the lack of cognitive effort expended by a learner during peripheral route processing, this approach can yield changes in evaluations and alterations of a learner’s cognitive structure, however typically in the short term. The lack of cognitive expenditure causes the attitude to be weakly integrated, and therefore able to dissipate quickly or become dissociated with the message (Petty et al., 2008).

This dual process model to persuasion has been tested extensively and the overarching premises that learners can be motivated to or unmotivated to process a message and accordingly rely on different informational cues (central and peripheral) have proven to be a robust framework.
CHAPTER III

METHODOLOGY

Design

One two-level factor, Mode of Graphic Presentation, yielded two between-subjects experimental conditions. A second factor, Hue, was nested in Mode of Graphic Presentation, and a third factor, Outcome, was nested in Hue. The resulting nested design was a 2-Mode of Graphic Presentation (Graphic vs. No Graphic) X 3-Hue (Gray vs. Green vs. Red) X 2-Outcome (Success vs. Failure).

Participants

Eighty-five undergraduate volunteers (65 percent female, mean age = 22.34, $SD = 5.06$ years) were sampled from a midsized university in the western United States, and randomly assigned to one of the six experimental conditions. Demographic data of the participants revealed that their primary language was English (93%); their average GPA was 3.17 ($SD = 0.58$); and, 48% of them reported psychology as their major, with the next highest reported major being nursing 7%.
Materials

The experimental materials used in this investigation consisted of a fictitious legal complaint, an experimental graphic, a colorblindness measure, a measure of skills in reading stacked-bar graphs, a demographic data sheet, and a multi-item perceptual rating scale.

Legal complaint

The legal complaint was a 47-word passage describing a lawsuit against a fictitious tire company regarding the company’s warranty of its tires. The complaint identified the parties involved in the lawsuit and the allegation against the company, specifically stating that not all tires sold met the company’s warranty.

Experimental graphic

The experimental graphic was a labeled stacked-bar graph, measuring 514 x 1202 pixels, showing one bar depicting, by a horizontal line, a 60/40% ratio between the relative success and failure of the company’s tires in meeting the warranty. The title of the graphic was labeled “warranty outcome”, and the y-axis was labeled “tires sold” and demarcated in 10% increments with numeric labels every 20%, from 0 to 100%. The graph was shown in either gray or color. When the graph was in color, it was either partially red and gray, or partially green and gray, with both red and green used for either success or failure in each version of the graph (see Figure 1).

The colors red and green were calibrated for luminance (L), chroma (C) and hue (h). Red LCh (56.22, 83.53, 51.74) and green LCh (57.65, 81.77, 133.91) were equated
for luminance and chroma. Gray LCh (57.85, 219.15), since it is an achromatic color, was equated with red and green for luminance only.

![Figure 1. Experimental Graphics](image)

**Measure of colorblindness**

Colorblindness was assessed using the Ishihara Colorblindness Test (ICT) (Ishihara, 1917 as cited in Thiadens et al., 2013), a compendium of 24 plates designed to differentiate individuals with red-green colorblindness. The plates are comprised of randomly placed and sized dots in which an individual must detect a target shape or number. There are five types of plates; test, vanishing, transformation, diagnostic, and hidden figures plates, in which colorblind and non-colorblind individuals identify targets. Of the five plate types, one test plate, one vanishing and six transformation plates were used to assess colorblindness in this investigation with inclusion criteria set at two errors. The ICT has been validated against the detection of Aviation Signal Lights (ASL) at both
day and night, Kappa = .74 (Mertens & Milburn, 1993). Thiadens et al. (2013) assessed the discriminative accuracy of the Ishihara test, specifically the test’s ability to discriminate between cone disorder patients and control subjects yielding a $c$-statistic of .888. A $c$-statistic of .985 was obtained for the instrument when discriminating between patients with normal color vision. Finally, Birch, (1997) and (2010) found that the ICT was sensitive to detecting differences between 98.4 and 99.0% for three errors.

Measure of reading skill for Stacked-Bar graphs.

Skill in reading a stacked bar graph was assessed by presenting participants with two labeled stacked bar graphs showing two bars depicting, by a horizontal line, the ratio of budget spending in California for jobs and education across two years (2011 and 2012). A 10-item graph skills measure was created from content in the graphs. Participants were asked to compare budget proportions between job and education spending in the same year and different years. Participants were also asked to combine budget proportions to make comparisons between job and education spending across years. Participants responded by indicating if a statement was true or false. There were four true and six false answers. The number of correct responses was summed to yield a measure of stacked bar graph reading skills. The sample of participants in the present investigation obtained a $M = 9.39$ and $SD = 0.95$.

Perceptual rating scale

A perceptual rating scale was designed to measure participants’: (a) evaluations of the fictitious company named in the complaint and (b) judgment of the company’s guilt. Participants were asked to indicate their agreement to the statement
“*Tires America Inc. is a _____ company.*” on a 9-point Likert scale, with 1 = strongly disagree and 9 = strongly agree. Twelve adjectives were sampled from framing, color and marketing literature. Six positive and six negative words were chosen; positive words included: admirable, trustworthy, reliable, sincere, sympathetic, and responsible. Negative words included: dishonest, unsuccessful, unapproachable, hostile, selfish and uncaring.

Participants’ were also asked to indicate their judgment of the company’s guilt by responding to the statement “I believe Tires America Inc. is _____” and were instructed to mark freely on an unmarked nine-inch scale with Guilty, Cannot Decide, and Not guilty evenly spaced on the line and were scored in 1/16 inch increments.

**Procedure**

Participants entered a campus computer lab and navigated the experimental website. Participants were read the Informed Consent and given instructions, and were then routed to one of six experimental pages. Instructions for the task were delivered verbally and presented at the top of the experimental page. The legal complaint was presented on the left portion of the screen below the instructions and was accompanied by one of six experimental graphics presented on the right portion of the screen. Participants were allotted 90 seconds to read the legal complaint and observe the experimental graphic. After 90 seconds had elapsed, participants were asked to complete the perceptual rating scales, a demographic data sheet, the measure of stacked-bar graph
reading skill, and the measure of color blindness. Finally, participants were read a
debriefing sheet, thanked for their participation, and excused.
CHAPTER IV

RESULTS

Data Source

Evaluations of the company were divided into two measures, one comprised of positive characteristics and the other negative characteristics. We created the measures by averaging responses to the six positive and six negative characteristics, with higher scores indicating more agreement. Cronbach’s alpha was computed for the two evaluative measures and indicated acceptable levels of internal consistency $\alpha=.852$ and .717 respectively for positive and negative evaluative measures. These two composite measures were entered as dependent measures into the experimental analyses and evaluated for statistical significance at an alpha level of .05.

Judgments of the company’s guilt were scored by ruler and calculated in 1/16-inch increments. This measure of guilt was entered as a dependent measure into the experimental analyses and evaluated for statistical significance at an alpha level of .05.

Achromatic Graph Presentation

First, we asked whether the presence or absence of an achromatic graphic presented in the context of a neutral legal complaint would influence evaluations of the company and judgments of guilt. Therefore, we tested the presence and absence of the
achromatic (gray) graphic on judgments of the company’s guilt, as well as the company’s positive and negative characteristics in a one-way MANOVA. The results yielded a multivariate $F(3, 23) = .75, p = .53$. The univariate test for positive characteristics yielded an $F(1, 25) = .20, MSerr = 1.24, p = .66$, negative characteristics $F(1, 25) = .16, MSerr = 1.21, p = .69$, and guilt, $F(1, 25) = 1.44, MSerr = 3.52, p = .24$. Thus, no reliable differences were observed for the presence or absence of the achromatic graphic presented in the context of a neutral case perspective on any of the evaluative measures of the company, or judgments of the company’s guilt.

Salient Chromatic Graph Presentation

We next tested, under the context of the neutral case perspective, the presence of the achromatic graphic (gray), the presence of a chromatic graphic making salient either success or failure of the company, and no graphic at all—in judgments of the company’s guilt, as well as evaluations the company’s positive and negative characteristics in a one-way MANOVA. The results yielded a significant multivariate effect $F(3, 81) = 4.18, p = .008$. The univariate test for positive characteristics yielded a nonsignificant $F(3, 81) = .732, MSerr = 1.17, p = .54$, a significant effect for negative characteristics $F(3, 81) = 3.05, MSerr = 1.15, p = .033$, and a marginal effect on guilt, $F(3, 81) = 2.43, MSerr = 3.14, p = .071$. Post-hoc Tukey analyses on the influence of the graphics on evaluations of the company’s negative characteristics indicated that the presence either of a chromatic graphic with failure made salient ($M= 5.16, SD = 1.18$) or success ($M= 5.16, SD = .91$) resulted in marginally ($p = .11$) more agreement that the
company exhibited negative characteristics compared to the absence of the graphic \((M=4.32, SD = .89)\). Post-hoc Tukey analyses on the influence of the graphics on perceived doubt of the company’s guilt revealed that when the graphic was absent \((M=3.66, SD = 1.55)\) participants had marginally \((p = .062)\) more doubt about the company’s guilt than when presented with the graphic making success salient \((M = 2.11, SD = 1.60)\). Taken together, these results suggest that participants’ evaluations of the company’s positive characteristics fail to be reliably influenced by the presence or absence of the graphics making salient either success or failure. However, evaluation of a company’s negative characteristics may be more negative when the chromatic graphic making salient either success or failure is presented. Furthermore, perceived doubt about the guilt of the company may be reduced when the graphic making salient the success of the company is presented compared to the absence of a graphic.

Chromatic Graph Presentation

We next tested, under the context of a neutral case perspective, the presence of the achromatic (gray) graphic, the presence of the chromatic (green) graphic, the presence of the chromatic (red) graphic, or no graphic at all on evaluations of the company’s guilt, as well as the company’s positive and negative characteristics in a one-way MANOVA. The results indicated a significant multivariate effect \(F (3, 81) = 4.29, p = .007\). The univariate test for positive characteristics yielded an unreliable \(F (3, 81) = .677, MSerr = 1.17, p = .568\), a significant effect on negative characteristics \(F (3, 81) = 3.16, MSerr = 1.14, p = .029\), and a marginal effect on guilt, \(F (3, 81) = 2.47, MSerr = \)
3.14, \( p = .068 \). Post-hoc Tukey analyses on the influence of the colored graphics on evaluations of the company’s negative characteristics indicated that the presence of the chromatic (red) graphic (\( M = 5.24, SD = 1.08 \)) resulted in marginally (\( p = .07 \)) more agreement that the company exhibited negative characteristics compared to the absence of the graphic (\( M = 4.32, SD = .89 \)). Post-hoc Tukey analyses on the influence of the graphic on perceived doubt of the company’s guilt revealed that when a graphic was absent (\( M = 3.66, SD = 1.55 \)) participants had marginally (\( p = .056 \)) more doubt about the company’s guilt than when presented with the chromatic (red) graphic (\( M = 2.08, SD = 1.84 \)) (see Figure 2). Taken together, these results suggest that participant’s evaluations of the company’s positive characteristics fail to be reliably influenced by the presence or absence of the chromatic graphics. However, evaluation of the company’s negative characteristics and perceptions of the company’s guilt are negatively effected by the presence of the chromatic (red) graphic compared to the absence of the graphic.

Differential Chroma Making Salient Success or Failure

We next tested, under the context of a neutral case perspective, the presence of the achromatic (gray) graphic, the presence of the chromatic (green) graphic making salient success, the presence of the chromatic (red) graphic making salient success, or no graphic at all on evaluations of the company’s guilt, as well as the company’s positive and negative characteristics in a one-way MANOVA. The results indicated a significant multivariate effect \( F(3, 51) = 4.15, p = .01 \). The univariate test for positive characteristics yielded an unreliable \( F(3, 51) = .343, MSerr = 1.06, p = .795 \), a marginal
negative characteristics $F(3, 51) = 2.55, MSerr = 1.03, p = .066$, and a marginal effect on guilt, $F(3, 51) = 2.58, MSerr = 3.02, p = .063$. Post-hoc Tukey analyses for the influence of the chromatic success graphic on evaluations of a company’s negative characteristics failed to reach a reliable level of statistical significance ($p = .15$ and .17). However, results indicated that regardless of the color used to make salient success, overall, evaluations were negative compared to the absence of a graphic. Post-hoc Tukey analyses on the influence of the chromatic success graphic on perceived doubt of the company’s guilt revealed that when the graphic was absent ($M= 3.66, SD= 1.55$)
participants had significantly more doubt about the company’s guilt than when presented with the chromatic (red) success graphic ($M = 1.78$, $SD = 1.74$). Taken together, these results suggest that participant’s evaluations of the company’s positive and negative characteristics fail to be reliably influenced by the presence or absence of the chromatic success graphic. However, doubt about the company’s perceived guilt can be reduced when presented with the chromatic (red) graphic making salient success; moreover, red has a function above and beyond mere salience, whereas green does not.

Next, we tested under the context of a neutral case perspective, the presence of the achromatic (gray) graphic, the presence of the chromatic (green) graphic making salient failure, the presence of the chromatic (red) graphic making failure salient, or no graphic at all on evaluations of the company’s guilt, as well as the company’s positive and negative characteristics in a one-way MANOVA. The results indicated a marginal multivariate effect $F(3, 53) = 2.59$, $p = .063$. However, all univariate analyses failed to reach a reliable level of statistical significance. These results indicated that evaluations of the company’s positive and negative characteristics and perceived guilt of the company failed to show a reliable influence of the presence or absence of the chromatic graphic making failure salient.
CHAPTER V

DISCUSSION OF EXPERIMENT 1

In Experiment 1, we sought to both replicate previous work on the influence of a graphic and a text on evaluations of a company in a litigation scenario, as well as to extend the research by investigating the influence of specific visual features of a graph. We suggested, that the presence of a statistical graph would provide informational cues that would influence a learner’s internal concept of the company. Our results partially supported these hypotheses—specifically, that salience and color in a graph influence a learner’s internal concept as measured by evaluations and judgments. However, our results failed to support the hypothesis that the mere presence of an achromatic graph would influence learner evaluations and judgments of a company’s guilt.

Contrary to the results of Park and Feigenson (2013), we failed to observe an effect for the presence of an achromatic graph. We suggested, that the graph would provide informational cues, thereby influencing the internal concept a learner formed of the company. In this investigation, we observed no influence on evaluations and judgments relative to the predicted influence of the informational cues Isberner, et al (2013) and Petty and Cacioppo (1986) reported. We believe that the graphic failed to influence evaluations, because the neutral case perspective provided with the text failed
to provide a point of reference for interpretation of the graph, an issue we address in Experiment 2.

In addition, we investigated how the presentation of a chromatic graph making content salient, compared to the presence or absence of an achromatic graph would influence learner evaluations of the company and judgments of the company’s guilt. When considering the role of salience, we suggested that the model proposed by Kriz and Hegarty (2007) and Hegarty (2011) would be the most useful for understanding the effect of salience on graph comprehension. This model states that salient visual features are differentially attended to and encoded into a learners’ cognitive representation of the display. Additionally, we suggested that the Petty and Cacioppo (1986) model of persuasion could explain additional sources of informational cues a learner takes from the graph. Specifically, that the salient content in the display would prompt central route processing, resulting in the learner elaborating on the graphic content. The data we obtained support the contentions by both Hegarty (2011) and Petty and Cacioppo (1986), that graphic content made salient influenced the internal concept a learner formed about the company. However, we hypothesized more positive evaluations for the salient success graph compared to the graph with failure made salient, but results indicated that both were evaluated less positively than the absence of the graphic. We believe that the negative evaluations of the company when success was made salient were due to the success of the company being only 60%—at best a marginal level of success that could be interpreted as “failing”. Despite this caveat, our work was similar to Sun et al. (2012) and Stone et al. (1997) in that we observed that making salient information in a graph can
influence learner evaluations. Furthermore, our results do provide support for the argument of Park and Feigenson (2013) that visual demonstrative evidence in court can influence juror decision-making.

We also considered the influence of color choice in a graph, and argued that Elliot and Maier (2012) and Moller et al. (2009) provided the most robust model regarding the effects of color. These authors stated that colors have a basic evaluative response, and that red is negative and green is positive. The data obtained from this investigation partially support this assertion. We observed that viewing red resulted in marginally more negative evaluations of the company and less doubt about the company’s guilt compared to the absence of a graph. However, our data failed to indicate that viewing green resulted in more positive evaluations of the company. Again, it is possible that the statistical values depicted in the graph and made salient by color communicated marginal company success, and that the association of green with positive evaluation was not able to augment the low performance of the company.

In this investigation, we were able to test the effects of the colors red and green representing both success and failure on learner evaluations of the company. Our results supported the hypothesis that viewing red representing success resulted in less positive evaluations compared to the absence of the graphic only, indicating that the color red can influence decision-making. However, our results indicated that there was no difference in evaluations of the company when failure was made salient by either red or green, compared to the presence or absence of a graph. This is an interesting finding in that we hypothesized that the negative association of red would influence learner
evaluations to be more negative. However, the overall low performance of the company may have created a floor effect, in that all learners evaluated the company in a similar fashion, because of the overall low performance of the company.

This investigation, while providing support that a graph can influence learner evaluations in a legal scenario was limited in one primary way— the lack of two case perspectives, a theoretical issue we addressed in Experiment 2.
CHAPTER VI

INTRODUCTION

Experiment 2 was designed to examine the influence of a graphic and a text on the cognitive representations formed by learners when the learners make evaluations of a company’s guilt in the context of a litigation scenario. However, in Experiment 2, we manipulated the legal complaint in a way more consistent with the legal setting—specifically, by pairing a graphic with a legal case perspective stated by either the defense or the prosecution. The results of experiment 1 failed to replicate the beneficial effect of pairing a legal statement with a graphic reported by Park and Feigenson (2013), and we argue that it was due to the legal statement in Experiment 1 being neutral and not framing the graphic for interpretation. Therefore in Experiment 2, we manipulated two legal complaints, one explicitly stating the failure of the company and the other stating the success of the company.

The manipulation of logically equivalent information as either success or failure (the glass is 50% empty or the glass is 50% full) is referred to as attribute framing (Levin, Schneider & Gaeth, 1998). Levin et al. (1998) state that attribute framing is the simplest form of message framing in that it presents a single attribute in one of two ways, one positive and one negative, and measures the message’s influence on learner evaluations.
Attribute framing has been applied in domains including, consumer evaluation (Levin & Gaeth, 1988; Levin, Gaeth & Schreiber, 2002), allotment of funds (Duchon, Dunegan & Barton, 1989), perceived vaccination effectiveness and support for a political candidate supporting vaccination (Bigman, Capella & Hornik, 2010), damage awards and company ethics (Dunegan, 1996), and judgments of psychiatric commitments in law (Scurich & John, 2011). Regarding evaluations, Levin and Gaeth (1988) in their foundational work, described a hamburger patty as 75% fat or 25% lean, and concluded that when described positively, the patty was evaluated more positively on indices of quality, taste, fat content, and greasiness. Furthermore, Duchon et al. (1996) investigated the allotment of funds to a research and development team when their past endeavors were described as 60% successful or 40% unsuccessful, with results indicating a stronger inclination to fund the team when exposed to a positive perspective describing their successes.

Regarding evaluations and judgments in the legal setting, Dunegan (1996) described an advertising agency as knowing 80% compared to not knowing 20% that their advertising was deceptive, and measured both damage awards and perceived ethics of the company. Their results indicated that when the company was described negatively, learners evaluated the company as less ethical and judged the company to pay damage awards that were 97% higher compared to a message that was positive. Furthermore, these damage award judgments were negatively correlated with evaluations of the company’s ethics. Finally, Scurich and John (2011) investigated the effect of framing an individual’s risk of future violence on judgments to release or commit the
individual to an involuntary 14-day psychiatric facility hold, and concluded that when the individual’s risk of violence was described positively compared to negatively, the individual was more likely to be released.

Entman (1993) stated that to frame, “is to select some aspects of perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, casual interpretation or moral evaluation”. Attribute framing is thought to influence evaluations by presenting a perspective for interpretation and encoding of stated information, resulting in a valence-consistent shift (Levin et al., 1998). A valence-consistent shift involves the positive evaluation of an object or person when the message is framed positively and negative evaluations when the message is framed negatively. Therefore, we argue that learners when presented with a positive case perspective compared to a case perspective that is negative will differentially evaluate the company’s characteristics and judgments of the company’s guilt in a litigation setting in a valence-consistent fashion.

However, none of the identified framing studies have included a statistical graph in the presence of their framed message. Park and Feigenson (2013) concluded that the effectiveness of a lawyer’s argument was aided by the presence of a PowerPoint presentation with statistical graphs. Specifically, they found that when a defense lawyer presented a PowerPoint, their client was judged as less responsible, whereas when a prosecution lawyer presented a PowerPoint, the defendant was judged as more responsible. We argue, that when lawyers contest a legal issue they are presenting logically equivalent perspectives of the same issue, and therefore can be seen as
manipulating the framing of one attribute. Thus, we contend that the positive and negative legal perspectives will be positively influenced by the presence compared to the absence of a statistical graph, by providing as Petty and Cacioppo (1986) identify, direct and peripheral informational cues that will influence the internal concept learner’s form of the company.

However, research also indicates that the presence of visual materials, and in particular graphs depicting part-whole relations, can nullify the effect of message framing on risk assessments (Garcia-Retamero & Galesic, 2010; c.f. Garcia-Retamero, Okan & Cokley, 2012 for an excellent review) and decision making (Garcia-Retamero & Dhami, 2013). Garcia-Retamero and Galesic (2010) were interested in the perceived risk of a surgery when the surgery was framed positively (991 of 1,000 survive) or negatively (9 of 1,000 die). In addition to the framed message, one of four visual conditions was presented, depicting the statistical data described in the text. In addition to a no graphic condition, an icon array, horizontal bar graph, vertical bar graph, and pie chart were presented. Results indicated that the presentation of any visual aid reduced the framing effect, but that the framing effect was negated when a graphic depicting a part-whole relationship was presented. In addition, Garcia-Retamero and Cokley (2011), provided support for the influence of graphics on behavioral intentions and evaluations. Specifically, they manipulated a health message stating either the potential losses of not using a condom and engaging in STD screening, or the benefits of using a condom and engaging in STD screening. The framed messages were paired with either a bar graph or no graph. Results indicated that the message paired with a graphic
was: (a) evaluated as more informative, (b) increased attitudes for STD screening and condom use, and (c) resulted in higher intentions to schedule an appointment with a doctor. However, the beneficial effect of the graphic resulted in both messages achieving similar positive evaluations and behavioral intentions, indicating that the presence of a graphic nullified the framing effect. Furthermore, Garcia-Retamero and Dhami (2013) demonstrated that the presence of a graphic influenced judgments and evaluations of trained decision makers. In particular, the accuracy of a counterterrorism technique was described in terms of success or failures, and police officers were asked to evaluate the accuracy of the technique and judge if they would recommend the technique to policy makers. Results indicated that, when a graphic was present, the framing effect was nullified so that evaluations and judgments did not differ. However, when the graphic was absent, evaluations of the technique’s accuracy, and judgments to recommend the technique to superiors were higher, demonstrating the framing effect. Therefore, we argue that the presence of a statistical graph paired with one of two texts may interact and influence evaluations of the company’s characteristics and judgments of guilt in one of two ways, either by enhancing the effect of the case perspective or nullifying it.

In addition to the presence of a graphic, we argue that the visual features of a graphic are not benign and that salience can influence evaluations and judgments similar to the results in Experiment 1. However, in Experiment 2 we also manipulated two case perspectives, one positive and one negative, in addition to a graph with either success or failure made salient, resulting in two sources of framed information, one textual and one graphical. Borah (2011) surveyed the framing literature and concluded that, only 3.2% of
the experimental research manipulated competing frames. In addition, Chong and Druckman (2007) stated that, research on competitive frames is germane to the field and we must seek to understand if competing frames: (a) cancel one another out, (b) reinforce existing values, or (c) influence motivation to seek alternatives.

In Experiment 1, we found that a graph with one of two outcomes made salient, influenced evaluations and judgments of the company. Specifically, that either a graph with success or failure made salient influenced evaluation of negative characteristics and doubt of the company’s guilt. In Experiment 2 however, we combine a case perspective and a graph with salient content, resulting in either a congruent or incongruent text-graphic combination. For example, a learner may be exposed to a positive case perspective and a graphic with failure made salient (incongruent) or a positive case perspective and a graphic with success made salient (congruent). As stated by Chong and Druckman (2007), the functions of competing frames are open questions. However, Chong and Druckman (2007) argue that two characteristics of a frame may predict the outcome of exposure when the frames compete, either that the “loudest” frame or the “strongest” frame will prevail. The loudest frame refers to the argument that is most frequently repeated (Chong, 1996), and functions regardless of frame strength, whereas the strongest frame refers to the evaluation of the quality of the argument including source credibility (Druckman, 2001) and agreement with learner beliefs (Sniderman & Theriault, 2004). Therefore, we argue that when graphic and case perspectives are congruent, the congruence will increase both the frequency of the positive or negative argument and provide additional strength relating to the quality of
the argument when a graphic is present (Isbener et al., 2013; McCabe & Castel, 2008). This enhanced frequency and perceived quality of the argument will influence the internal concept a learner constructs about the company and thereby influence evaluations and judgments of the company. However, we approach the interaction of incongruent case perspectives and graphics as an open question regarding how they will influence the construction of an internal concept and evaluations and judgments of the company.

As argued and demonstrated in Experiment 1, the differential use of color to create salient content in a graphic influenced evaluations of the company, and judgments of the company’s guilt. To support this argument, we presented evidence on the different evaluative response to the colors red and green, citing a red negative and green positive link (Elliot & Maier, 2012; Moller et al., 2009). However, as stated, the aim of Experiment 2 was to investigate the influence of a graph and specific visual features of that graph under one of two valenced case perspectives.

Through our survey of the literature on framing and graphics, we encountered only one study that systematically manipulated framed messages and color on evaluations. Gerend and Sias (2009) conducted a study on the effectiveness of gain and loss framed messages on behavioral intentions to vaccinate when exposed to the color red or grey. Gerend and Sias (2009) presented learners with a binder whose cover page had a gain or loss framed title surrounded by a red or grey rectangle. Their results indicated that vaccination intentions were greater only when learners were presented a red binder cover and a loss framed message. The authors argued that the presentation of red acted
as a subtle threat cue increasing the effectiveness of the message that focused on the potential risks of not engaging in the vaccination behavior. This finding provides evidence for the interaction of message framing and color on learner evaluations and decision-making, an interaction we investigate in this study.

Despite the lack of experimental investigations into message framing and color, we argue that viewing either red or green in a graph will alter the effect of the frame. According to Elliot and Maier (2012), the evaluative response to a color has a reciprocal relationship with affect, behavior and cognition, and therefore the individual viewing the color determines the basic evaluative response to the color. We argue, that the case perspective a learner reads will influence the evaluative context the learner uses to determine the meaning of the color. Elliot and Maier (2012) define a context as, “the set of circumstances that frame a color and determine its’ meaning in integrated fashion”. Attribute framing research has consistently shown that when exposed to a perspective that is positive compared to negative, evaluations of the target are more positive (Duchon et al., 1989; Dunegan, 1996; Levin & Gaeth, 1988; Scurich & John, 2013). Therefore, we argue that when presented a positive frame describing the successes of the company, a learner will have a different evaluative response to the color viewed. Maier, Barchfeld, Elliot and Pekrun (2009) provided evidence for this argument in an investigation that examined infant preference for colored toys under a positive or negative context. Maier et al. (2009) established a hospitable context, defined as positive by exposing infants to a smiling face, and a hostile context defined as negative by showing infants a scowling face. Their results indicated that when exposed to a smiling face (hospitable context)
infants preferred the red toy compared to a toy that was green, however, in the hostile context green toys were preferred to red. Preference according to Tesser and Martin (1996) can be viewed as a basic form of evaluation as well, thus providing a link between Maier et al. (2009) and our investigation. Additionally, Elliot and Niesta (2008) concluded a similar positive evaluative effect of red when viewed on a prospective mate. Elliot and Maier (2012) articulate the point best by stating that: “motivational valence… can likewise moderate the meaning of red, with a hospitable context leading to a positive evaluation of (and preference for) red and a hostile context leading to a negative evaluation of (and aversion to) red”. Therefore, we contend that viewing a color, specifically red in either a positive or negative context will influence the meaning of that color and provide a peripheral informational cue (Petty & Cacioppo, 1986) influencing the internal concept a learner forms of the company thereby altering evaluations of the company’s characteristics and judgment of the company’s guilt.

Finally, we argue that the object on which a color is viewed will also influence the evaluative response to the color, in addition to the evaluative response established by the text frame. As Elliot and Maier (2012) state, the evaluative meaning of a color is subject to both the affective, behavioral and cognitive state of the individual as well as the object on which the color is viewed. For instance, a learner may be exposed to a case perspective that is positive, and a graph with the color red making salient success. In this instance, the meaning of the color red would arise from both the case perspective and the graphic content. The results of Experiment 1 supported the argument that the content represented by the color can influence evaluations of the
company—specifically, we concluded that judgments of guilt were influenced when the color red depicted success. Previously, we argued that viewing red under a positive case perspective would result in a positive evaluative response to the color. These case perspective and graphic pairings present an additional uninvestigated question regarding the effect of competing informational sources including text, graphic content and color.

The Present Investigation

In Experiment 2, we aimed to create a more ecologically valid representation of the legal setting, and therefore included two perspectives of the same legal event. We argue that two perspectives allow for a more realistic investigation into the influence of graphics on decision-making in a litigation scenario. If as Levin et al. (1998) state, a positively framed message results in more positive evaluations compared to a message that is negative, it simulates the arguments and desired outcomes of lawyers. We argue, that a lawyer for the defense frames their client in a positive light, whereas a prosecution lawyer frames the defendant in a negative light. We see these dual perspectives as the missing component in replicating the results obtained by Park and Feigenson (2013). Therefore in Experiment 2, we manipulated case perspective and the presence or absence of a graph, on evaluations of a company’s characteristics and judgments of guilt. If as Isberner et al. (2013) state, the presence of a graph serves as an informational cue, the internal concept a learner derives of the company will be influenced. However, the exact influence of the graphic on the valenced case perspectives is unknown, in that conflicting results regarding the effect of a graphic on valenced texts have been found.
In addition, Experiment 2 allowed us to address the influence of multiple sources of information (text and graphic), which are either congruent or incongruent on evaluations and judgments. As Borah (2011) and Chong and Druckman (2007) stated, few studies have investigated the influence of competing sources of information, let alone when the sources of information are a text and a graphic. However, two characteristics of the competing messages may explain the effectiveness of the information presented. One characteristic is the frequency of the message, specifically, that the more frequent message will prevail (Chong, 1996), whereas the other characteristic of the message relates to the strength of the information (Druckman, 2001). Regardless of characteristic that prevails, both assume that informational cues are provided and processed by the learner, similar to the assumption Petty and Cacioppo (1986) make.

Furthermore, we sought to extend the findings of Experiment 1 regarding the influence of color on evaluations of the company’s characteristics and judgments of guilt. In Experiment 2, we were able to investigate the differential evaluation of the same color, when viewed under both a positive and negative case perspective. If, as Elliot and Maier (2012) and Moller et al., (2009) state, the evaluative response to a color is partially determined by the evaluative state of the observer, the presentation of a positive perspective compared to a perspective that is negative will influence the evaluation of the color. This evaluative response will provide a peripheral informational cue resulting in influences on the internal concept a learner forms of the company, thereby influencing evaluation and judgments of guilt (Petty & Cacioppo, 1986).
Finally, we argued that the color used to make salient content in a statistical graph would interact with the positively or negatively framed case perspective a learner is exposed to, and provide informational cues thereby influencing evaluations and judgments of the company’s guilt. If, as Levin et al. (1998) state, positively framed messages result in positive evaluations, and if as Elliot and Maier (2012) state, evaluative responses to colors are influenced by both the evaluative state of the individual and the content on which the color is viewed, we argue that influences on evaluations and judgments of guilt will occur when a learner processes the three informational sources.

Hypotheses

If, as Levin et al. (1998), Dunegan (1996) and Scurich and John (2013) state, evaluations of targets framed positively compared to negatively result in more positive evaluations, we hypothesize that learners shown a positively framed case perspective will evaluate the company more positively and judge them to be less guilty compared to a case perspective that is negative. In addition, we propose competing hypotheses regarding the interaction between the case perspective and the presence or absence of an achromatic graphic on evaluations of characteristics and judgments of the company’s guilt. If as Park and Feigenson (2013) and Isberner et al. (2013) state, graphs provide peripheral informational cues that positively influence evaluations of the argument they are paired with, learners will differentially evaluate and judge the company. We hypothesize that evaluations of the company will be more negative or positive when a negative or positive case perspective is paired with an achromatic graph compared to all
other text graphic combinations. Alternatively, if as Garcia-Retamero and Galesic (2010) and Garcia-Retamero and Dhami (2013) state, graphs that visually represent part-whole relations nullify the influence of message frames, we hypothesize a different interaction for case perspective and the presence or absence of an achromatic graphic. Thus, we hypothesize that evaluations of the company will be more positive or negative when the positive or negative case perspective is presented in the absence of an achromatic graph compared to all other combinations. In sum, we offer competing hypotheses regarding the interaction of a framed message and an achromatic graphic, one hypothesizing an enhancing effect of the framed message when the graph is present, and one hypothesizing a negating effect of the framed message when the graph is present.

In addition, we aimed to investigate the interaction of a case perspective and a chromatic graphic making salient either the success or failure of the company. According to Borah (2011), little work has been conducted on the effects of competing frames; therefore, we only make predictions relative to the congruent case perspective and graphic conditions. If as Chong and Druckman (2007) and Chong (1996) state, the frequency and strength of a message determine their effectiveness, we predict that two sources of congruent information and the peripheral informational cues provided when a graph is present (Isberner et al., 2013) will influence the learner’s internal concept of the company and therefore evaluations and judgments. We hypothesize that congruent success or congruent failure text and graphic combinations will result in respectively more positive and negative evaluations than the presence or absence of an achromatic graph.
In addition, if as Elliot and Maier (2012) state, a color’s evaluative response is partially determined by the evaluative state of the observer, and attribute framing has been found to manipulate the evaluative state of the learner (Levin & Gaeth, 1998), we hypothesize that when presented a case perspective that is positive, learners will more positively evaluate the company when red is viewed compared to green (Maier et al. 2009), or the presence or absence of an achromatic graph. However, when the case perspective is negative, green will result in more positive evaluations compared to red. The findings in Experiment 1 indicated that although green is positive, the statistical data depicted is overall indicative of low performance, therefore we argue that the positive effect of green will only result in more positive evaluations compared to viewing red in the negative case perspective, but that viewing green will not differ from either the presence or absence of an achromatic graph.

Furthermore, we were interested in the evaluations and judgments of a company when only the colors red and green were used in the graph. As previously stated, we predict evaluations to be more positive when exposed to a case perspective that is positive compared to negative, and for evaluations to be more positive when success is made salient compared to failure. However, we also hypothesized interactions between these three factors, specifically that when a text and graphic perspective are congruent (positive, success) evaluations would be more positive than all other combinations citing a frequency effect and strength effect for the message (Chong & Druckman, 2007). Accordingly, we hypothesized more negative evaluations when the text and graphic pairing were congruent and negative (negative, failure), compared to all other text graph
combinations. Furthermore, we hypothesized an interaction between the case perspective and color viewed in a graph, specifically that evaluations would be more positive when red is viewed under a positive case perspective, compared to green, and that green would lead to more positive evaluations when the case perspective was negative. Regarding the interaction between the salient content in the graph and the color used to create that salience, we hypothesize no interaction between the factors due to the interaction we hypothesize for the case perspective and color. We argue that the case perspective alters the evaluative response to a color and that the two-way interaction of color and salient content will be nonsignificant due to this.

Finally, we hypothesize a three-way interaction between case perspective, salient content, and color. We argue, that the case perspective partially influences evaluation of a color in addition to the object on which the color is viewed, and that a positive case perspective results in positive evaluation of the color red. However, viewing red representing failure may communicate negative information. Therefore, we hypothesize, that when a positive case perspective is presented in conjunction with a graphic making salient success in red, evaluations will be more positive than all other combinations except for the positive case perspective, paired with a graphic making success salient in green. In addition, we hypothesize that the presence of a negative case perspective in conjunction with a graphic making salient failure in red will result in more negative evaluations compared to all other combinations of text and graphic.
CHAPTER VII

METHODOLOGY

Design

The basic experimental design consisted of two factors, Mode of Graphic Presentation and Case Perspective, yielding four between-subjects cells. A second factor, Hue, was nested in Mode of Graphic Presentation, and a third factor, Outcome, was nested in Hue. The resulting nested design was a 2-Mode of Graphic Presentation (Graphic vs. No Graphic) X 2-Case Perspective (Positive vs. Negative) X 3-Hue (Gray vs. Green vs. Red) X 2-Outcome (Success vs. Failure).

Participants

One hundred sixty-five undergraduate volunteers (73 percent female, mean age = 22.07, SD = 5.01 years) were sampled from a midsized university in the Western United States, and randomly assigned to one of twelve between-subject experimental conditions. Demographic data of the participants revealed that their primary language was English (90%); their average GPA was 3.11 (SD = 0.54); and, 60% of them reported psychology as their major with the next highest reported major being undeclared 5%.
Materials

Legal complaint

The legal complaint was the same 47-word passage used in Experiment 1; however, we manipulated the final statement describing the company’s success or failure in meeting the warranty resulting in two 51-word passages. When the complaint referred to the company’s success, it stated that 60% of the tires sold met the warranty. When referring to failure, the complaint stated that 40% of the tires sold failed to meet the warranty.

The experimental graphics, measure of colorblindness, measure of reading skill for stacked-bar graphs, and perceptual rating scales were identical to those used in Experiment 1.

Procedure

The procedure was identical to experiment 1 except participants were routed to one of 12 experimental pages and one of two legal complaints was presented on the left portion of the screen.
CHAPTER VIII

RESULTS

Achromatic Graph Presentation and Case Perspective

As in Experiment 1 we first asked whether the presence or absence of the achromatic graphic presented in the context of the positive or negative legal complaint would influence evaluations of the company’s characteristics and perceptions of the company’s guilt. Therefore, we tested a 2-Mode of Graphic Presentation (presence vs. absence of an achromatic (gray) graphic) X 2-Case Perspective (negative vs. positive), two-way MANOVA on evaluations of the company’s guilt, as well as the company’s positive and negative characteristics.

The results yielded a marginal multivariate effect for Case Perspective $F(3, 48) = 2.06, p = .118$, but results were not statistically significant for Mode of Graphic Presentation $F(3, 48) = .369, p = .776$ or the interaction, $F(3, 48) = .27, p = .847$. The univariate tests of Case Perspective on positive characteristics yielded an $F(1, 50) = 5.78, MSerr = 1.54, p = .02$, a nonsignificant effect on negative characteristics $F(1, 50) = 1.10, MSerr = 1.45, p = .299$, and a marginal effect on guilt, $F(1, 50)= 2.57, MSerr = 3.41, p = .115$. When exposed to the positive case perspective ($M = 3.96, SD = 1.34$) compared to the case perspective that was negative ($M = 3.14, SD = 1.08$) participants
agreed significantly more that the company exhibited positive characteristics. Furthermore, perceived doubt of the company’s guilt was marginally greater when reading the positive case perspective ($M = 3.08, SD = 1.91$) than the case perspective that was negative ($M = 2.29, SD = 1.75$).

Taken together, no reliable differences were observed for the presence or absence of an achromatic graphic presented in the context of either the positive or negative case perspective on evaluation of the company’s negative characteristics. However, marginally significant differences were found for the positive case perspective on evaluations of the company’s positive characteristics and perceptions of the company’s guilt regardless of the presence or absence of the achromatic graphic.

Salient Graph Presentation and Case Perspective

We next tested, under the context of the positive or negative case perspective, the presence of the achromatic (gray) graphic, the presence of the chromatic graphic making salient either success or failure of the company, or no graphic at all on evaluations of the company’s guilt, as well as the company’s positive and negative characteristics in a two-way MANOVA.

The results yielded a significant multivariate effect for Case Perspective $F (3, 155) = 3.10, p = .029$, and a nonsignificant effect for Mode of Graphic Presentation $F (3, 157) = 1.62, p = .188$, however, their interaction was significant $F (3, 157) = 4.50, p = .005$. The univariate tests of Case Perspective on positive characteristics yielded an $F (1, 157) = 8.53, M{Serr} = 1.28, p = .004$, a nonsignificant effect on negative characteristics $F$
(1, 157) = 1.70, MSerr = 1.33, p = .194, and a significant effect on guilt, $F(1, 157) = 4.04, MSerr = 3.67, p = .046$. When exposed to the positive case perspective ($M = 3.63$, $SD = 1.25$) compared to the case perspective that was negative ($M = 3.16$, $SD = 1.01$) participants agreed significantly more that the company exhibited positive characteristics. In addition, perceived doubt of the company’s guilt was significantly greater when exposed to the positive case perspective ($M = 2.98$, $SD = 2.09$) than the case perspective that was negative ($M = 2.43$, $SD = 1.73$).

This main effect is qualified by the significant multivariate interaction between Case Perspective and Mode of Graphic Presentation, however, all univariate analyses failed to reach a reliable level of statistical significance. Taken together these results indicated that viewing the positive case perspective regardless of the presence or absence of the graphic with success or failure made salient or an achromatic graph with no salience, resulted in more positive evaluation of the company’s positive attributes and more perceived doubt about the guilt of the company.

**Chromatic Graph Presentation and Case Perspective**

We next tested, under the context of the positive or negative case perspective, the presence of the achromatic (gray) graphic, the presence of the chromatic (green) graphic, the presence of the chromatic (red) graphic, or no graphic at all on evaluations of the company’s guilt, as well as the company’s positive and negative characteristics in a two-way MANOVA. The results indicated a significant multivariate effect of Case Perspective $F(3, 155) = 3.02, p = .031$. No other significant multivariate effects were
found, Mode of Graphic Presentation $F (3, 157) = 1.49, p = .220$ or the interaction $F (3, 157) = 1.54, p = .206$. The univariate test for Case Perspective on positive characteristics yielded a significant $F (1, 157) = 8.43, M{Serr} = 1.31, p = .004$, a non-significant effect on negative characteristics $F (1, 157) = 1.72, M{Serr} = 1.33, p = .192$, and a marginal effect on guilt, $F (1, 157) = 3.61, M{Serr} = 3.77, p = .059$.

When exposed to the positive case perspective ($M = 3.63, SD = 1.25$) compared to the perspective that was negative ($M = 3.16, SD = 1.01$) participants agreed significantly more that the company exhibited positive characteristics. In addition, perceived doubt of the company’s guilt was significantly greater when exposed to the positive case perspective ($M = 2.98, SD = 2.09$) than the case perspective that was negative ($M = 2.43, SD = 1.73$).

Taken together, these results suggest that participant’s evaluations of the company’s characteristics and judgment of the company’s guilt fail to be reliably influenced by the presence or absence of the chromatic graphic in either red or green, or the achromatic graphic. However, evaluation of the company’s positive attributes and judgments of the company’s guilt are negatively effected by the presence of a negative case perspective.

**Differential Chroma Making Salient**

*Success or Failure*

We next conducted a 2-Case Perspective (positive vs. negative) X 2-Graphic Salience (success vs. failure) X 2 Hue (red vs. green) three-way MANOVA to understand the combined influence of the factors on evaluations of the company’s positive and
negative characteristics as well as judgments of the company’s guilt. Results indicated significant multivariate interactions for Case Perspective and Graphic Salience $F(3, 101) = 4.18, p = .008$ and Graphic Salience and Hue $F(3, 101) = 3.21, p = .03$.

Univariate analyses for the interaction of Case Perspective and Graphic Salience indicated a significant effect on evaluations of the company’s guilt $F(1, 103) = 3.70, MSerr = 3.88, p = .05$. Simple main effects tests with a Bonferroni correction revealed that participants presented the positive case perspective and the graph with success made salient ($M= 3.52, SD= 2.52$) had significantly ($p = .02$) more doubt about the guilt of the company than participants presented either the positive case perspective and the graph with failure made salient ($M= 2.42, SD= 1.77$) or the negative case perspective and the graph with success made salient ($M= 2.30, SD= 1.43$) ($p = .044$) (see Figure 3). Thus, case perspective and presentation of the graphic with an outcome made salient by color interact to influence judgments about the guilt of a company—specifically, doubt of guilt can be altered when the positive case perspective is paired with the graphic that has either success or failure made salient by color.
Figure 3. Interaction of Case Perspective and Salient Graphic Content on Doubt of Guilt

Univariate analyses were also conducted on the interaction of Graphic Salience and Hue, resulting in a reliable influence only on evaluations of the company’s positive characteristics $F(1, 103) = 6.77, MSerr = 1.12, p = .011$. Simple main effects tests with a Bonferroni correction indicated that the presence of the red graphic making salient success ($M = 3.79, SD = 1.01$) resulted in significantly ($p = .01$) more positive evaluations of the company compared to the presence of the red graphic making salient failure ($M = 2.99, SD = 1.18$) (see Figure 4). Green failed to reliably influence evaluations of the company’s positive or negative characteristics or doubt about the company’s guilt.
Further univariate analyses indicated a significant interaction of Case Perspective and Hue on evaluations of the company’s negative characteristics $F(1, 103) = 4.50, MSerr = 1.27, p = .036$. Simple effects tests with a Bonferroni correction indicated that individuals presented the positive case perspective and the red graphic ($M=4.49, SD=1.28$) evaluated the company significantly ($p=.05$) more positively than individuals presented the negative case perspective and the red graphic ($M=5.08, SD=1.07$) (see Figure 5).

Taken together these results indicate that the color red influences evaluations of the company differently relative to the case perspective with which it is paired.
Figure 5. Interaction of Hue and Case Perspective on Evaluations of Negative Characteristics.
CHAPTER IX

DISCUSSION OF
EXPERIMENT 2

Experiment 2 aimed to extend the findings of experiment 1 by including two logically equivalent perspectives of the same case. We argued, that the lack of a reference point in the neutral case perspective used in Experiment 1 might have accounted for the failure to replicate the findings of Park and Feigenson (2013). However, the data we observed in Experiment 2 failed to support our contention that a point of reference was necessary to replicate the findings, for we concluded that regardless of the presence or absence of an achromatic graph, the case perspective influenced the decision-making of the learners. We proposed competing hypotheses, stating that a graph would either enhance the effect of the case perspective (Park & Feigenson, 2013) or nullify the effect of the case perspective (Garcia-Retamero & Dhami, 2013; Garcia-Retamero & Galesic, 2010), however, we failed to support either. The graphic neither enhanced nor nullified the case perspective, in that overall, learners evaluated the company more positively when exposed to the positive perspective regardless of the presence or absence of an achromatic graph. These results are interesting in that the learners were not affected by the presence of the graphic at all, indicating that they may not have attended to it when presented, a limitation we return to.
In addition, we failed to replicate the results observed in Experiment 1 regarding the influence of salient graphic content, or the interaction of the salient content and case perspective. Interestingly, whereas we hypothesized that congruent text and graphic pairings would increase the frequency of the case perspective and provide informational cues influencing learner internal concepts and evaluations, we failed to observe an effect. Our results indicated that the presence of a graphic with either success or failure made salient failed to influence evaluations of the company. It appears that learners may not have processed the additional source of information, or the influence of the case perspective was the primary source of information that learners used when making their decision. A possible explanation is that the graphic depiction, regardless of salience was not as salient and overt as the text based case perspective. This finding is new for the message framing and graph literature and must be addressed in future studies.

Furthermore, we failed to replicate the evaluative effects of viewing red or green compared to an achromatic graph observed in Experiment 1. Our results indicated that across all graphic conditions, the text had the only systematic influence on learner evaluations and judgments, and that viewing a color did not influence evaluations of the company compared to the presence or absence of an achromatic graph. The recurring finding of the case perspectives influence may indicate that the addition of the graphic for this specific legal complaint, and these specific statistical values did not provide strong informational cues and was unable to influence the construction of a learner’s internal concept of the company.
However, when we narrowed the scope of our investigation to only the effects of red and green, we were able to tease apart differences in the subtle effects of the graphic’s visual features. We found that when the color red was viewed under a positive case perspective compared to a perspective that was negative, evaluations of the company’s negative characteristics were lower, indicating that the evaluative response to the color red can be manipulated by the framing of a message that is logically equivalent, as adapted from Elliot and Maier (2012). Previous work on the evaluative responses to color had manipulated an overt context (Elliot, Maier, Binser, Friedman & Pekrun, 2009; Elliot & Niesta, 2008; Meier, D’Agostino, Elliot, Maier & Wilkowski, 2012) or established a context using a picture (Maier et al. 2009), however, in this investigation we manipulated the evaluative context through a valenced case perspective.

Interestingly, we observed support for the frequency hypothesis regarding congruent text and graphic information (Chong, 1996). Our results indicated that when the case perspective and graph emphasized the success of the company evaluations were more positive. However, our data did not indicate the same frequency effect for a congruent failure text and graphic combination, providing partial support for our hypothesis. Again, we argue that the overall low performance of the company created a floor effect for manipulations describing the failure of the company.

In addition, we observed an interaction between the content made salient in the graph and the color used to create the salience. Our data indicated that evaluations were no different when green depicted success or failure, but that red representing success was evaluated less negatively than red representing failure. According to Elliot
and Maier (2012) the object on which a color is viewed can also determine the evaluative response to the color, and our results provide evidence for this statement, specifically that red representing success is evaluated more positively or less negatively than red representing failure, but that evaluations of green do not differ for success and failure.

Furthermore, the results of Experiment 2 indicate that a case perspective systematically influenced evaluations of the company, in line with Levin and Gaeth (1998), Dunegan (1996) and Scurich and John (2011). However, the hypothesized interactions between the text and graphic failed to support previous research, for both salience and overall evaluations to color. However, when we looked at only the effects of colors relative to one another we found interactions between the text, graphic, and salient content in the graph.
CHAPTER X

GENERAL DISCUSSION

Our results provide new information regarding the influences of demonstrative evidence in simulated litigation scenarios. The list of visual evidence identified by Feigenson (2010) can be amended to included stacked-bar graphs. Additionally, Park and Feigenson’s (2013) statement that the visual features of a graph may influence juror evaluations and decision-making has been supported. Specifically, this investigation provided evidence that salience, and the specific color used to create salience influence learner evaluations and judgments.

The results of Experiment 1 indicated that a neutral legal complaint can be influenced by a statistical graph making content salient, and differentially so when the content is made salient by either red or green. Similar to the work by (Maier et al., 2012), we concluded that red results in negative evaluations of the target being evaluated. However, we also demonstrated that evaluations can be positive when a positive evaluative context is established similar to the results of Maier et al. (2009). In addition, we provide evidence that color influences human decision-making in an additional context, the legal setting.

Furthermore, our results support Kriz and Hegarty’s (2007) and Hegarty (2011) model of graph comprehension by providing evidence that the visual features of a
display can influence the representation a learner forms of a company. We also provide evidence that color may act as a peripheral informational cue that although not central to the message content is able to influence the internal concept a learner forms (Petty and Cacioppo, 1986).

In addition, we replicated the findings of Levin and Gaeth (1998), Dunegan (1996) and Scurich and John (2011), in that a message framed positively compared to negatively resulted in more positive evaluations than a message that was negative. However, when we investigated the interaction between a case perspective and a graphic, neither of our competing hypotheses were supported. The presence of a graph did not enhance the argument it was paired with (Park & Feigenson 2013). Park and Feigenson (2013) exposed their participants to more than 50 minutes of legal material whereas we had a mere 90-second exposure time. Park and Feigenson (2013) argued that more complex material may shed light on the influence of visual materials in court, and may offer an explanation for the null effects we observed. Although we failed to replicate their work, we demonstrated that learners can be influenced by a 90 second exposure to legal material. The presence of a graph also failed to nullify the framing effect as concluded by Garcia-Retamero and Galesic (2010) and Garcia-Retamero and Dhami (2013). Several explanations exist for the reason that the presence or absence of a single achromatic did not influence learners. The content of the graphic itself may have been too close in ratio to influence learners. Isberner et al. (2013) in their experiment included two statistical graphs to provide plausibility cues to the learners and argued that one graph may not be adequate.
However, our results did provide evidence that the colors red and green communicate different information, and that the decision to include color in any visual presentation needs to be considered because colors influence decision-making. We argued that the color would act as a peripheral informational cue influencing learner’s construction of an internal concept of the company, and that hypothesis was supported by our results.

Limitations

This study was limited in several ways including the use of a convenience sample, that while including potential jurors was not representative of the juror pool for the state of California regarding ethnicity, gender or socioeconomic status. Furthermore, the small sample size collected in the study must be acknowledged when interpreting the results of the investigation. Although we attempted to establish a mock legal context and instructed learners to assume the role of a juror, they were in an experimental laboratory that was not the ecologically valid setting in which these findings would apply.

An important limitation was that our exposure to legal material was brief and not directly representative of the legal setting. In this experiment, we exposed learners to a single legal statement and one piece of graphic evidence for only 90 seconds, a task that is not representative of the time jurors must spend understanding trial information. Furthermore, as Petty and Cacioppo (1986) state, learner motivation and need for cognition may mediate the processing of the information presented, and this study would have benefitted from such a measure. Finally, and most importantly, this study did not
permit jurors to discuss case information, and therefore ignored the didactic nature of the jury decision-making process.

Future Research

Future research should investigate several variables including, the display format of the graphic (i.e. pie, bar, line, scatterplot etc.), the ratio of the statistical data depicted, the complexity of the case information, and the length of exposure time. Furthermore, research should look at the effects of additional colors on decision-making. An interesting goal of future work will be to see if graphs function differently according to who is being evaluated, either an individual or a company, and for what specific allegation. Additionally, the use of eye-tracking technology would provide a valuable metric to understanding the use of visual material by a juror; although we argued that a learner would attend to the visual display we have no direct measure of their gaze patterns. As can be seen, there is much work to be done in this developing domain.

Implications

The implications of this study are widespread, most notably for the construction of visualizations in litigation. Guidelines already exist regarding the types of evidence allowed in courtrooms, however, this investigation provides evidence that salience and color can differentially influence evaluation of a company in a legal setting. If the goal of the court is to bar biasing materials, the results of this study would recommend that only an achromatic graphic should be allowed as demonstrative
evidence. However, as other studies have reported, visual evidence can clarify difficult concepts, and improve recall of trial information, which also biases decision-making (Park and Feigenson, 2013). The results of studies conducted regarding visualizations in litigation forecast difficult choices for judges and legal professionals, in that evaluations can be biased by the presentation of visualizations.

The results of this study also extend to advertising and marketing where a company only has a brief time in which to expose a learner to their materials. This study indicates that evaluators can be influenced in a brief exposure time and that different aspects of the materials including color and salience influence these decisions.
REFERENCES
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