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Literature Review

According to The Department of Transportation and the Federal Highway Administration Office of Safety, “One-third of all intersection crashes in the United States and more than forty percent of fatal crashes, occur at stop-sign controlled intersections” (The Department of Transportation; Federal Highway Administration Office of Safety). These percentages are high considering stop signs are meant to reduce accidents at dangerous intersections. Unfortunately, these statistics are especially alarming for the elderly as “the risk of being injured or killed in a motor vehicle crash increases as you age” (“Older Adult Drivers”). This increase in risk of injury stems from multiple causes including vision impairment from age (“Older Adult Drivers”). It is well known that a person’s vision declines as they age, so it is very important for road signs to be clearly visible. The goal of a stop sign as stated by The Department of Transportation, the expert contact for this study, is to “reduce crashes and congestion.” Why then are so many accidents occurring at stop signs when “traffic control devices are tested to ensure they are visible, recognizable, understandable, and necessary” (The Department of Transportation)? That was the research question for this study which focuses on any improvements that can possibly be made to stop signs to make them more eye-catching. The hypothesis is that if a stop sign is more eye-catching then there will be accident reductions as people will be able to clearly see the sign,

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thus making them more effective. However, this study does not involve actually changing the color and shape of stop signs at intersections as permission would have to be obtained to do that; instead, this study focuses on determining the most eye-catching color and shape as the results can be applied to stop signs. Color is one of the main components of stop signs that make them so recognizable and distinguished; the bright red is supposed to draw the driver’s attention and signal them to stop. In this sense, stop signs could be considered flawed as the accident rates are alarmingly high at stop signs. Therefore, red might not be the most eye-catching color as people are failing to stop. Stop signs are in the octagon shape, a supposed unique and eye-catching shape; this could also be flawed as many people are failing to stop. This study tests both color and shape as it tries to prove which combination is the most eye-catching, and the most effective to be used for stop signs in order to reduce accidents.

Red did not always signify the driver to come to a stop. Stop signs were first proposed by William Phelps Eno in 1900 (Greenbaum and Rubinstein). The idea behind stop signs was to prevent accidents at intersections by forcing the driver to come to a complete stop and to observe their surroundings before continuing down the road. Interestingly enough, some researchers argue today that stop signs should be completely done away with as “without them people would have to pay more attention to their surroundings” (Greenbaum and Rubinstein). However, the Department of Transportation views stop signs as relevant and necessary, so it is unlikely for stop signs to be removed anytime soon. This argument brings up an interesting point as stop signs are failing to do their job as one study done in four U.S. cities contrastingly revealed that “[s]eventy percent of all crashes in the cities resulted from stop signs violations” (Insurance

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Institute for Highway Safety). This percentage is high for stop signs to be considered effective, so one study tried to reduce the number of accidents at stop signs as “700,000 [accidents] occur annually at stop signs, and approximately one-third involve injuries” (Insurance Institute for Highway Safety). In Winston-Salem, stop signs were made larger from the standard twenty-four inches to thirty inches. This proved successful as by the end of the study, “The city experienced an average crash reduction of 56.9 percent per year at intersections with larger stop signs” (Federal Highway Administration Office of Safety). The thirty inch signs cost only three hundred fifty dollars and took just three months to implement, yet stop signs are still allowed to be 24 inches (Federal Highway Administration Office of Safety). This study proved that stop signs were difficult to see as when they were made with larger dimensions accidents were significantly reduced, thus making this study logical as stop signs clearly need improvements. The main strength in the Winston-Salem study comes the statistics and data collected as well as findings of the study; however, the study does not include enough background research to explain the strategy that was chosen to improve the stop sign. They failed to explain why increasing the size of the stop signs would reduce accidents at intersections. The study needs a more detailed rationale as its only support is that some drivers admitted to violating stops signs because of “poor visibility of the signs” (Federal Highway Administration Office of Safety; Insurance Institute for Highway Safety). Another study in the four U.S. cities found that “[d]rivers younger than 18 and older than 65 were at fault most of the time [in accidents occurring at stop signs]” (Insurance Institute for Highway Safety). This relates back to the poor vision in the elderly and accidents occurring from the failure to see. The solution this study offers is to possibly change

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the color and shape of the stop sign to something more eye-catching as stop signs are only red because the color red is associated with stop (Greenbaum and Rubinstein). In fact, stop signs were originally yellow in 1935 but changed to red in 1954 because “red has always been associated with stop” (Greenbaum and Rubinstein). The four U.S. cities study supports this change in color as it does well in its statistics. However, the study again lacks in its detail of the accidents and causes of the accidents. In the other article, Greenbaum and Rubinstein complete their purpose of providing the reader with the history of the stop sign, but they end the article abruptly with the idea of stop signs not being employed. Each article and study succeeds in its purpose and help to point out the flaws in stop signs as well as the need for improvement in visibility, but they do not have the proper support they need that this study will have.

The rationale for this experiment can be explained through the alarming statistics of crashes, but also through the definition of color. Color is defined as “the physical phenomenon of light or visual perception associated with various wavelengths in the visible portion of the electromagnetic spectrum” (“Color”). Since every color has a different wavelength, all colors are perceived differently. As the entry “Color” in *Funk & Wagnalls New Encyclopedia* explains, “the perception of color is a complex neurophysiological process” (“Color”). The difference between colors is the smallest difference in wavelength, and this microscopic difference results in different perception as well as emotions from viewing the color. In the article “Psychological Properties of Colours”, Angela Wright describes different colors and the effects they have on a

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person. The article explains, “Red has the property of appearing closer and raises the pulse rate. Blue is calming. Green is the color of balance. Orange results in a physical and emotional reaction. Pink is soothing, and gray has no direct psychological properties” (Wright). Based on this information, it could be assumed that red is the most eye-catching color as it evokes a physical response; however, the article goes on to say that “[y]ellow has a long wavelength and is stimulating in emotion making it the strongest color psychologically” (Wright). This information claims yellow to be the most eye-catching color leading to the true hypothesis of this experiment (what can really be tested in this experimental study), if yellow is the strongest color psychologically then it is the most eye-catching color. Wright does an excellent job in listing out the colors and their properties, but she does not provide any research to support her claims. The article “12 colours and the emotions they evoke” takes Wright’s claims a step further in explaining “every color elicits a different unique emotion” (Cao). Cao analyzes properties of colors such as brightness and claims that “brighter colors are more energetic and invoke this energy” (Cao). This information can be related to the study as brighter colors create energy, so they are more eye-catching. Red also heightens awareness which would make a driver more alert while yellow can “activate the anxiety center of the brain” (Cao). Jerry Cao’s strength in his article is his analysis of the colors, but again he does not have any research to support his claims. However, his analysis of red and yellow does contribute to yellow possibly being more eye-catching than red. Another article titled, “Color and Vision Matters”, better explains why yellow is the strongest psychological color in explaining it is an “eye irritant”. The article explains that “...more light is reflected by bright colors resulting in excessive stimulation of the

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eyes. Therefore, yellow is an eye irritant” (“Color and Vision Matters”). This is the first article that explains why yellow is so strong, but the article again has no research to support its claim. This study, however, will finally provide evidence as several articles claim that “yellow is the first color the eye notices” (“Color and Vision Matters). The author needs to have research to support a claim of this nature, but he does not. All of these articles make interesting claims, but do not have the research to back which color is the most eye-catching.

In the article, “Does Your Company Have the Right Logo? How and Why Circular-And Angular-Logo Shapes Influence Brand Attribute Judgements”, the author supports his claim through a study he conducted. Jiang explains his study in the article and reveals his results. He conducted a study on company logos and how companies were perceived based on their logo. Jiang found, “Companies with circular logos typically get more customers and better ratings” (Jiang). He even offers an explanation to the results in that “[c]ircular shapes activate associations with softness while angular shapes associate hardness. Circular shapes invoke caring, warmness, and sensitivity” (Jiang). Jiang does an excellent job of analyzing the results of his study, and this can relate to the current study and the shapes of stop signs. Based on Jiang’s results, an angular or pointed shape would be more eye-catching as people tend to lower their guard around something they find comfortable. Therefore, an octagon is not a bad shape for a stop sign as it should draw attention with its sharp edges and corners. Jiang’s study is the only study that was found relating to shape and how it catches the eye. This new study will analyze

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both shape and color as it works to find the most appropriate fix for stop signs. All the background research points to stops signs being ineffective as accident rates are high and people claim to have visibility problems. In Winston-Salem, simply enlarging the stop signs lowered accident rates. If stop signs were to change color and shape people would be forced to pay attention to them which could possibly decrease car accidents and fatalities. The only way to prove these claims is for research to be collected.

The articles claim that yellow is the most eye-catching color but offer no evidence to their claims; therefore, a study must be conducted. The question of this experiment is what is the most eye-catching color and shape? The results of this study will relate back to stop signs and hopefully be used to decrease the number of accidents that occur at stop signs each year as The Department of Transportation offered a link to suggest any improvement to current signs. A computer, internet access, a website with which an anonymous survey can be conducted, pictures with multiple colors, and pictures with multiple shapes are the needed supplies in this experiment. The first step in this experiment is to create a survey with questions which answers will reveal the most eye-grabbing color. This survey will be done through surveymonkey in order to bypass the human consent forms as their environment is not being changed. This survey will be set up in five different sections. The first section will be the basic information section which will ask questions about age, gender, location of residence (which state they live in), and eyesight. This will provide a basic understanding of the subject. The next section will be opinion

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based questions about stop signs and colors. The third section will be filled with colorful pictures and ask the subject to identify the first color they saw. There will be twelve pictures in this section. The following section will be about shapes. This section will have pictures filled with collages of shapes and again ask the subject to identify which shape they saw first. There will be seven pictures in this section. The final section will be four pictures of colorful shapes and it will ask the person taking the survey which color and shape they saw first. Appendix A is the first survey. After this survey is created, a link will be shared on a Facebook page targeted at an older audience (a middle-aged female’s page with friends her age and older) to lure in the preferred subject pool. This pool consist of older aged people with poor vision. This data will be collected over a span of three weeks. After three weeks, another survey will be created with other pictures (these pictures will have different colors) but the same types of questions. This survey will also be up for three weeks. After the third week, another survey will be created with different pictures and it will be up for three weeks before it is closed and data collection is over. The survey has been up since November third and so far the most eye-catching color is red with fourteen participants so far. Red has been selected 32 percent of the time (some of the pictures used were from intersections). However, blue was selected the most by the elderly and chosen 26.8 percent of the time. Data collection is still early, but the shape that was chosen the most so far is the triangle which has been chosen 24.5 percent of the time. In total the red octagon (stop sign) has only be chosen 48.8 percent of the time. This is actually low as the background is gray in most of these pictures which should allow the stop sign to pop. The rest of data collected in the survey will come from the pictures in the survey and the answers. These results will be broken down

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into the percentages each color accounted for in the survey. Each subject who took the survey answers will be tallied. The colors and shapes will be broken down into the percents they make up in the surveys. The gender and age of the subject will also be accounted for and graphed to show any patterns. This data analysis will be effective as it will prove which color and shape are the most eye-grabbing. The results of this experiment can be used to reduce accidents across the world.

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Appendices

1. Appendix A (first survey): <https://www.surveymonkey.com/r/DL6HYF9>