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Change blindness and the relationship of college students with different majors

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CHANGE BLINDNESS AND THE RELATIONSHIP OF COLLEGE STUDENTS WITH DIFFERENT MAJORS

by
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Dedication

I dedicate this manuscript to my parents, Erika and Harvey Friedman

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I would like to acknowledge Dr. Allen and Dr. Dihoff for their encouragement and guidance throughout my research.

Abstract

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Change blindness is defined as a psychological phenomenon that occurs when a change in a visual stimulus goes unnoticed by the observer (Boundless, 2013). .Change blindness can be any change in one's visual field and occurs due to the lack of attention or obstruction in one's visual field. A variety of factors influence change blindness, and gender became a major part to research. The purpose of this study was to study the influence of gender on change blindness and the relationship to college students' majors. Past research has shown us that females tend to be more visually detailed than males. Depending on what major males or females have, the majors will influence the participants' visual fields. The following hypotheses to study this topic included that: Individuals in engineering, and/or science majors will be a lot quicker to notice the changes in the experiment compared to all other majors and females in engineering, and science will respond the quickest in the study. Rowan University students of the various majors will be given a series of images and will identify if any changes have or have not occurred. It is expected that results will show that women in engineering, and science majors will have the quickest response times because of their sharp visual fields. This research has implications for determining if women would do better in specific fields because of their strong visual fields overcoming change blindness.

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Chapter 1

Introduction

Need for Study

Study change blindness and how it visual compares to individuals of different majors. Research has been done to prove that change blindness shows significant difference among gender, age, and being visually impaired. However, not a lot of research has be done to compare college students in different fields of study. This experiment will help to determine if one group of individuals has a sharper eye and can determine change blindness quicker.

Purpose

Change Blindness occurs when a visual stimulus goes undetected in one's visual field. The purpose of this study was to expand and learn more about the topic of change blindness in relation to college majors and gender. Previous research has found significant findings of change blindness and gender. This study was created to uncover new data for future direction.

Hypotheses

The first hypothesis is that individuals in an engineering or biology major will be able to determine the visual aspects and differences quicker than those who are not in the specific major**.** The second hypothesis is that the female participants who are engineering or science majors will be able to determine the visual differences quicker than the males in that field.

Assumptions

Each participant will answer each question honestly and therefore the data will not be skewed. The participants will try their best and those who are color blind will not be participating in the experiment. In the end, the data will be honest and fair among all of my participants.

Limitations

The limitations of this experiment was the small sample size and the images used. Having a smaller sample size will make it harder to conclude if the data was accurate or not. Also, the images that were used may not have been the best one's for the experiment. Participants may have struggled with them or thought they were too easy.

Summary

What is change blindness? Change blindness is a psychological phenomenon that occurs when a change in a visual stimulus goes unnoticed by the observer. Various research has found that change blindness has multiple variables that influence a person's visual field. A major variable of change blindness is gender and how men and women perceive the world differently. The work of Nelson, Metzler, and Reed (1974) laid the groundwork for change blindness and gender. All of the research on change blindness and gender drew a link to one's personality. In 2006, Peter and Umbach researched that one's personality and choice of college major has a direct connection. The variables of one's personality and college choice seemed to reflect back on change blindness. Although, not a lot of research has been done to show a major relationship between one's college major choice and change blindness, the present research allows for further expansion on the topic and for testing to be completed. Women's sharp visual field

allows them to be more proficient in certain fields of work/study versus their male counterparts.

Chapter 2

Literature Review

Change blindness is defined as a psychological phenomenon that occurs when a change in a visual stimulus goes unnoticed by the observer (Boundless, 2013). It is the idea that our brains and eyes do not notice certain changes in scenery, pictures, and/ or human features. Change blindness occurs because of the lack of attention or obstructions in the visual field of the observer. This could be due to the fact that our brains are expecting to see the visual stimuli as we normally do but fail to notice the change. Change blindness and other related phenomena (e.g. inattentional blindness, the attentional blink.) demonstrate that people's experience of the visual world is far more limited than one would think: Large changes presented in the center of the visual field fail to be detected, incongruous moving objects escape detection, and so forth was stated by Laloyaux , Destrebecqz, and Cleermans (2006) cited by Rensink, R. A. (2000b). In Rensink's original research, he stated that change blindness is a rather striking phenomenon: a change made to an image during a saccade, flicker, or other such interruption that would often be difficult to detect, even if it is large and easily seen once noticed (Rensink, O'Regan, & Clark, 1997; Simmons and Levin 1997). Rensink, O'Regan, and Clark (1997) studied change blindness over the years using a variety of testing to determine what factors play a role in change blindness.

Research has shown us that there are a variety of factors than can influence change blindness. Downing &Pinker (1985), found the first important factor in which we focus our attention on objects in our present field of vision. It is well known that we can enhance or prioritize the processing of stimuli by orienting or focusing our attention at

that location (Downing & Pinker,1985; Eriksen & St. James, 1986; Posner, 1980). Downing and Pinker (1985) studied change blindness to determine that attentional distribution or how we focus on the object in our visual field becomes an important variable when determining the presence of change blindness. Downing and Pinker (1985) proposed a quite different model of attentional distribution. They suggested that the allocation of attention to a spatial location produces a gradient of attention whose peak is centered at the expected location and whose density decreases with increasing distance from the expected location (Egly &Homa, 1991). Egly and Homa (1991) carried out the work of Downing and Pinker (1985) by testing the participant's visual fields. The experiment required the participants to focus on a central object and given cues as to where the other objects would appear to the individual. Egly and Homa (1991) used Downing and Pinker's (1985) model of attentional distribution to test 135 participants in 7 experiments and concluded that the present research provides important information on the temporal limitations of attention movements, as well as broader implications regarding models and methodology for visual selection. The findings are quite compatible with the notion that the movement of the attentional focus is a spatially related phenomenon (1991). Attentional distribution or the process of focusing our attention plays a major role in change blindness and has explained another variable that influences change blindness. How we focus our attention is determined by our working memory and what we allow in our visual field. Our working memory seems to influence the concept of change blindness.

Learning that our visual field functions based on the amount of stimuli presented in our working memory, researchers, Hollingsworth and Henderson (2002) studied the

Accurate Visual Memory for Previously Attended Objects in Natural Scenes . The goal of this study, then, was to investigate the nature of the information retained in memory from previously attended objects in natural scenes. The study sought to resolve the apparent discrepancy between evidence of poor change detection (and visual transience hypotheses which seek to explain such change blindness) and evidence of excellent memory for pictures Hollingsworth and Henderson (2002). Hollingsworth & Henderson (2002) conducted three experiments in which the participants first would attempt to detect the type of change that was taking place (Experiment 1), the participants than had to detect the rotation and change of the images (Experiment 2), and lastly the participants had to detect the type of change, the rotation/orientation, and a test of their long term memory (Experiment 3). Hollingsworth and Henderson (2002) found that the data suggests that relatively detailed visual information is retained in memory from previously attended objects in natural scenes. This research would launch further investigation of how our working memory use influences change blindness was respect to gaze, or the amount of fixation we spend on an object.

Droll and Hayhoe (2007) studied change blindness and tradeoffs with gaze and working memory use. In the course of visually guided behavior, the brain must make multiple decisions about what visual information from the environment to sample. Visual scenes typically abound with complex information, but the brain is fundamentally limited in how much information can be encoded and stored. Gaze is directed to only one area at a time, visual attention may modulate the information selected during each of these fixations, and the capacity of visual working memory sets strict limits on the ability to store the attended information across successive fixations. Thus, the brain must

constantly decide where to look, what to attend, and what to remember (Droll& Hayhoe, (2007). Droll and Hayhoe (2007) studied the eye movements during natural tasks which suggest that observers did not use working memory to its capacity. This is because a task requiring extended behavior can be organized in a variety of ways. For example, when fixating on an object, the observer may either decide to store this information in working memory or not to store this information and simply refixate the object the moment it becomes necessary (Droll and Hayhoe, 2007). The present experiment by Droll and Hayhoe (2007) hypothesized an increased reliance on the just-in-time strategy by adding a further increase to the working memory load, in an attempt to better understand when subjects use working memory as opposed to overt fixations. They concluded instead that observers used eye movements to acquire relevant information immediately before it was needed. Results showed that this strategy is sensitive to memory load and to the observer's expectations about what information will be relevant. Droll and Hayhoe (2007) revealed that change blindness depends critically on the local task context by virtue of its influence on the information selected for storage in working memory.

Change blindness is influenced by the task at hand due to our working memory and the focusing of our attention impacts our visual field. Understanding how much stimuli is presented to our working memory will determine how well we can focus or not. With this is mind, there was research completed by Fernandez-Duque and Thornton (2000) to determine whether or not a memory overload will cause discrepancies in one's visual field. In other words, they attempted to manipulate the orientation of the object to see how that would influence change blindness. Fernandez-Duque and Thornton (2000) created an experiment to explored whether undetected changes can nevertheless be

processed and influence subsequent processing. After this study was complete, it left room for an alternative hypothesis to form. Building on this idea, Mittroff, Simons, and Franconeri (2002) replicated Thornton and Fernandez-Duque's experiments and also other studies purporting to demonstrate implicit change registration (Williams & Simons, 2000) or localization (Fernandez-Duque &Thornton, 2000; Smilek, Eastwood, & Merikle, 2000), and claimed that all the behavioral evidence for implicit change detection or conscious strategies rather than on unconscious sensitivity to change. However, Fernandez-Duque and Thornton retested their theory in 2003 on working memory overload.

The Implicit Change Identification of an object studied by Laloyaux et al. (2006) had participants using simple change detection task of vertical and horizontal stimuli to determine the orientation of the object. The current researchers replicated the study to eliminate any methodological biases from the previous experiments done by Fernandez-Duque and Thornton. Fernandez-Duque and Thornton (2003) and Mitroff et al. (2002) changed the paradigm so much that it made it simply impossible to obtain any congruency effect. In other words, Fernandez-Duque and Thornton consider that observing a congruency effect in aware trials constitutes a prerequisite to obtain the same effect in unaware trials. All of this previous research would lay the groundwork for Laloyaux (2006) and his research team to further the work of Fernandez-Duque and Thornton (2003). Their experiment would help researchers determine if the orientation of an object causes change blindness to occur a lot sooner. Like the previous research, the participants had to identify the visual images on the screen and determine what changes had occurred. As that was happening, a distractor was put in place to test the awareness

of the participants. They concluded that a person's conscious decision about the orientation of an item appears to be influenced by previous undetected changes in the orientation of other items in the display. Their results were congruent to Fernandez-Duque and Thornton's 2003 model.

The work of Fernandez-Duque and Thornton (2003) and Laloyaux et al. (2006), explained that a variety of factors influence change blindness especially the orientation of the object. In their experiments, they put distractors in place to manipulate the dependent variable or one's visual field. Change blindness was studied by Watson and Kunar (2010), who tested visual masking and change blindness. They expanded on previous research by setting distracters before the target being observed, which was studied by the participants. They conducted five experiments to see whether such objects are still effective in recapturing attention if the changes occur while the previewed objects are masked. Watson and Kunar (2010) cited the previous research of Downing et al. (1985) who stated: "humans are usually faced with much more visual information than they can process in one go. Given this potential overload of input, for behavior to be efficient, we need to be able to focus on the most relevant visual information at any given time and ignore less relevant or distracting stimuli." Research demonstrated that it can be incredibly difficult to notice large changes occurring in a scene if the natural visual transients of the image are masked (Watson and Kunar, 2010). The first experiment that was done by Watson and Kunar (2010) had the participants observe objects in various columns on a screen and then masked during the presence of new objects. In the other four experiments, the researchers changed the shape of the objects, placed distractors at various degrees, and occlusion change preview condition. Overall, the findings showed

that by masking an object, it becomes more effective in preventing change of that object. Also, by presenting a new object, it increases the attentional load of the participants.

A variety of variables seem to play a role in change blindness. However, one major variable that was not discussed in great detail among the research was gender. Does gender affect change blindness? In past research, Nelson, Metzler, & Reed (1974) attempted to study effect of detail on the visual processing of scenes. Their experiment included undergraduate students to study the detail of long-term recognition of photos and verbal descriptions in a variety of stimuli to determine which form of detail can be remembered more easily. Nelson, Metzler, & Reed (1974) concluded that their results implied recognition advantage for pictures over verbal descriptions is not due to the extra details which pictures contain. In their study of gender and visual detail, gender did not influence the participants' results. Although these results did not answer the question about change blindness and gender, it would lay the groundwork for further research.

Forte, Mandato, & Kayson, (1981) tested the effect of gender on change blindness which included gender-stereotyped magazine advertisements. It was hypothesized that females would recall more details from female oriented advertisements and males would remember more from male-oriented advertisements. This would show that gender-stereotypes in advertising still have the effects hoped for by the companies which run them. Stereotypical male and female -related advertisements were observed between male and female participants. After observing each for five seconds, the females recalled more details over-all. Females recalled more details in advertisements than males. Males recalled more details from the male-related advertisements, while females recalled an equal number of details from both advertisements (1981).

It has been suggested that, in a visual-spatial task, women may do more local than global processing and that women often prefer to process verbally while men tend to prefer spatial strategies (Kail & Siegel, 1978, Caplan, MacPherson, & Tobin, 1985). The work of Caplan, MacPherson, & Tobin (1985) helped to find more conclusive data about sex differences. In their research, they found supporting theories to explain that men use more spatial techniques unlike women who prefer a verbal approach. This work was replicated in 1986 by Hamel and Clark and in 1994 by Wetzel, Radtke, and Stern. The research by Hamel and Clark (1986) and Wetzel, Radtke, & Stern (1994) would once again study the effect on detail on visual processing scenes but look for any sex differences that may affect the results. In summarizing their results, the researchers explained that the generally accepted rule in instructional design using visual media is to use a moderate amount of detail to present what is relevant to the instructional task (Wetzel, Radtke, & Stern, 1994).

A study done by Hamel and Ryan-Jones (1997) compared men and women through two learning trials to determine the effect of gender on change blindness. The hypothesis conducted by Hamel and Ryan-Jones (1997) was to determine if sex differences played a role in processing the detail of visual scenes. This experiment included male and female participants who had to assess the effect of visual detail on scene recognition. They observed high detail and a reduced detail of various scenes. Both men and women were assessed in two versions of the test. Version one would remove specific details of the objects by using a blurring technique and version two would remove even more detail and put various lines in place of landmarks. Hamel and Ryan-Jones (1997) concluded that of greater interest was the hypothesis that visual detail would

affect recognition; this hypothesis was only partially supported. With this being said, women performed better in this study because of how they processed the information. All in all, these results have implications for the design of simulated environments. They suggest that whether detail is a significant design issue may depend on the subjects' cognitive processing styles (Hamel & Ryan-Jones 1997).

As previously stated, change blindness affects our visual fields by a variety of variables and our gender contributes to it. The research of Hamel and Ryan-Jones (1997) concluded gender, change blindness, and the types of decisions we make are all related to our everyday lives. Taking it one step further, our gender will influence what types of careers or jobs we will found ourselves in for the future. In a recent review, Newman, Fuqua, and Minger (1990) concluded that gender differences in career development may exist along various dimensions and recommended the use of multiple measures and more complex methodology and the inclusion of a broader range of cognitive variables for the study of this issue. Gati, Givan, & Osipow (1995) studied *Gender Differences in Career Decision Making: The Content and Structure of Preferences* to identify possible sources of the observed differences in the career choices of women and men, three facets of career preferences were examined: the relative importance attributed to career-related aspects, the within-aspect preferences (i.e., desirable characteristics of occupations), and the structure of aspects derived from these within-aspect preferences. A career assisted guidance system program monitored 2,000 young adults to find a variety of results. The data had shown that (a) only small gender differences in the relative importance of the aspects, (b) considerable gender differences in the within-aspect preferences, and (c) certain gender differences in the structure of aspects (Gati, Givan, & Osipow, 1995). In

essence, the analysis revealed that gender differences in a selecting a career goal do influence an individual's decision making.

The work of Gati, Givan, and Osipow (1995) would open the door for further research to determine what type of influences and aspects that both genders face. Malgwi, Howe, and Burnaby (2005) developed a hypothesis on the influences on students' choice pertaining to their college majors. Their objective was to find the positive and negative factors on why a particular student chooses a certain major. To date, research has established that students choosing business majors (as opposed to nonbusiness majors) are affected by parental occupation and socioeconomic status, with the strength of that effect differing by gender (Leppel, Williams, & Waldauer, 2001). After surveying 3,800 undergraduate students at a business university, Malgwi, Howe, and Burnaby (2005) compared the results of those who were freshmen, of those who changed their majors, and then the gender differences. The findings showed that interest in the subject was the most important factor for incoming freshmen, regardless of gender. For women, the next most influential factor was aptitude in the subject (2005). Just as the research had found, gender did not influence their decisions but women wanted to know something and be well-educated in their career choice. A large body of research suggests that personality plays a critical role in college student major choice. Astin (1993) argues that students with certain personality characteristics are more likely to choose particular majors. Having this in mind, Porter and Umbach (2006) expanded the research in a study entitled *College Major Choice: An Analysis of Person-Environment Fit.*

Porter and Umbach (2006) used the Holland Personality Scale to determine the relationship between a person and their environment to see how their

characteristics/personality fit a particular college major. The results had shown that academic preparation, family influence and academic self-efficacy do not seem to matter after taking into account personality (2006). Individuals who did test high in artistic ability would chose a career art or music but did so because of their great interest in that field. Outside factors play a role in a student's choice but their personality largely influences them. The data did also show that racial differences had a significant effect on the student's choices unlike gender.

The significance of Peter and Umbach's (2006) work shows us that personality dictates a person decision on college major choice. However, there seems to be certain underlying characteristics of what draws an individual to a certain field. Again in 2006, Goyette and Mullen studied college major choices and the consequences of the undergraduate field of study. Goyette and Mullen (2006) created a research design to determine what types of factors contribute to a person's selection on their college major. The data was collected from the National Educational Longitudinal Study (1994) that surveyed bachelor level students from 1990, 1992, and 1994. The goals of this research were to examine and explain the influence of gender, race, and, particularly, SES on major choice, and to document the influence of major on career outcomes. Though certainly not all student closely follow one of these routes, we have uncovered two trajectories through the college years and beyond clearly shaped by social background (2006). Goyette and Mullen (2006) helped to uncover the main factors that relate to a student's major choice to lay the ground work in distinguishing how these factors affect one another.

In 2008, Beggs, Bantham, and Taylor researched the various factors that influence a college student's choice of major by using a variety of surveys to find validity and reliability. Collins and Giordani (2004) reported that 68.4% of the respondents chose their major because they liked the kind of work it would enable them to do as compared to 7% who picked their major for its earning potential. *Distinguishing the Factors Influencing College Students' Choices of Major,* describes the two types of studies that Beggs, Bantham, and Taylor (2008) used to weigh the importance of what factors take more priority to a student's choice. The first type of study conducted was a Means-End Survey which informed the college students of what factors an individual typically looks for when selecting their major. The categories included Informational Search on one's major, Psych/Soc. Benefits, Job Characteristics, Match Interests, Financial Planning, and Major Attributes. Once this survey was completed, a Qualitative Study was given to the participants. Beggs, Bantham, and Taylor (2008) scaled the categories by having the participants' label which factor to them was the most important and which factor was the least important to them. According the results of this study, if students are basing their major choice on their perceived major and job characteristics and their perceptions are not accurate, the benefits of a good major choice will not accrue to any of the stakeholders (2008). By conducting these two studies, research has shown us that one's perception of a major and job characteristics depend on what the participant knows and wants to know about their particular field of study. These perceptions of individuals fall back on one's personality. Beggs, Bantham, and Taylor's (2008) work tied the factors and one's personality together to show that previous research was correct on how a major is selected. Personality characteristics are the underlying factor of why an individual acts

and thinks a certain way. In one of the largest studies to date, Lounsbury, Smith, Levy, Leong and Gibson (2009) found that 347 business student scored significantly higher than 2,252 nonbusiness majors on the personality traits of agreeableness, conscientiousness, emotional stability, extraversion, openness, assertiveness, and tough-mindedness-but not on optimism or work drive.

Pringle, Dubose, and Yankey (2010) extended the person-environment fit by analyzing the data of undergraduate business majors. However, these researchers were attempting to uncover the traditional stereotypes of the working field. Surveying 899 students on a web –based survey, Pringle, Dubose, and Yankey (2010) reached out to 8 different business major groups to find 6 important personality characteristics that drive us as human beings. These specific character traits include achievement, motivation, conformity, conscientious, creativity, and extroversion. Each of the personality traits were measured and scored based on the appropriate scale associated with the web-based survey. The results did show that the various traits matched up with a particular major. The results indicated that international business majors scored higher in achievement and motivation, accounting majors scored higher in conformity, and marketing majors scored higher in extroversion. In conclusion, stereotypes have long played an integral role in career decision making. While this practice may have simplified thinking about such important matters, changes in occupations increasingly cast doubt upon the accuracy of the process. As a result, the likelihood that members of any profession can be accurately categorized through simplistic stereotypes is wishful thinking at best (2010). This research has shown us that personality characteristics dictate decisions and choices we make each and every day especially one's pertaining to our college major choice. The

various characteristics however whether an innate feeling or environment influence, all relates back to what we know and live by: society's expectations.

Society is a major factor of our environment that controls our behaviors and decisions. It sometimes governs us to the point of what men and women are expected to do and what will be a "natural occurrence" for society. It seems that due to our environmental and biological factors, women tend to be a lot more visually-orientated than men. This statement was tested to develop a theory on why this may be. The reason being, women process all their outside experiences in their visual and cognitive field differently than men do. Men however are proficient in spatial relations to their visual field where women connect their verbal abilities visually. The research found on gender and change blindness helps society to understand that women are more visually detailed than men.

Since our gender and change blindness are connected, this explains why society tends to rule in our behaviors and decisions. Women will go into certain fields of work and are stronger in those fields because of change blindness. However, not a lot of research has been found or done to determine if change blindness appears as a major factor in college student's particular majors. The more this topic is researched and studied, the more information will be discovered through future research.

Chapter 3

Methodology

Participants

The participants used in this experiment were chosen from the Rowan University Undergraduate Pool. There were 15 students (6 males and 9 females) who took part in this study. There were 4 biology majors, 3 engineering majors, and 8 others consisting of criminal justice and psychology. The design was staged throughout the campus for individuals to participate if they were interested. Mostly, individuals were found in the cafeteria were they completed a consent form. After filling out the consent form, the males were screened for color blindness so it would not skew the data. Individuals were given a serious of images with color differences and had to identify the changes. Those who tested positive to color blindness were excluded from the study. In the experiment, color may have been a factor in testing change blindness and if someone was color blinded, they were at a disadvantage to begin with. Those who males who did test positive with color blindness were able to join their female counterparts and participate in the study.

Variables

The Independent Variables that were used in this study were college majors: biology, engineering, and other majors; and the gender of the participants. The Dependent Variable of this experiment was the time the participants took to view the selected images. A stop watch was used to keep track of the participant's reaction time to the images.

Procedure

Once the consent forms and screening processes were complete, the participants were able to take part in this study. Next, they were given a booklet comprised of the change blindness images. In the booklet, all 10 images were gathered for the participants. The participants were asked to view each image for only about 10 seconds and then were asked to view the image again for 15 seconds. All of the participants were timed with a stop watch to make sure no one was given more than 15 seconds. Also, the stop watch helped to determine which participants answered quicker than others. Following the original image, a changed or edited image was presented to the participants. The participants had to explain what the change was. After every image was observed, the study was completed. A Statistical Analysis of the data was done in order to compare the male and female participants.

Results

A between- subjects analysis was run to compare engineering, biology, and other majors and gender of the participants. A one-way analysis of variance (ANOVA) was calculated to assess whether change blindness score varies significantly according to a participant's indicated major. A one-way analysis of variance (ANOVA) was also calculated to assess whether change blindness score varies significantly according to a participant's indicated gender.

Chapter 4

Results

In testing the relationship of change blindness and college students' majors, no significant results were found. In collecting the data, a between- subjects analysis was run to compare engineering, biology, and other majors. The means of the majors started to approach significance but was not significant to the sample size or F values. Biology majors had a mean of 101.95 seconds, engineering majors had a mean of 106.33 seconds, and the other majors had a mean of 117.88 seconds. The following data can be found in Table 1 below.

Table 1
Descriptive Statistics: Major Sample Population

Major	Mean	Std. Deviation	N
Engineering	106.3333	19.21805	3
Biology	101.9500	25.32212	4
Other	117.8750	6.79154	8
Total	111.3200	16.37660	15

Figure 1 shows the overall means of the engineering, biology, and other majors below.

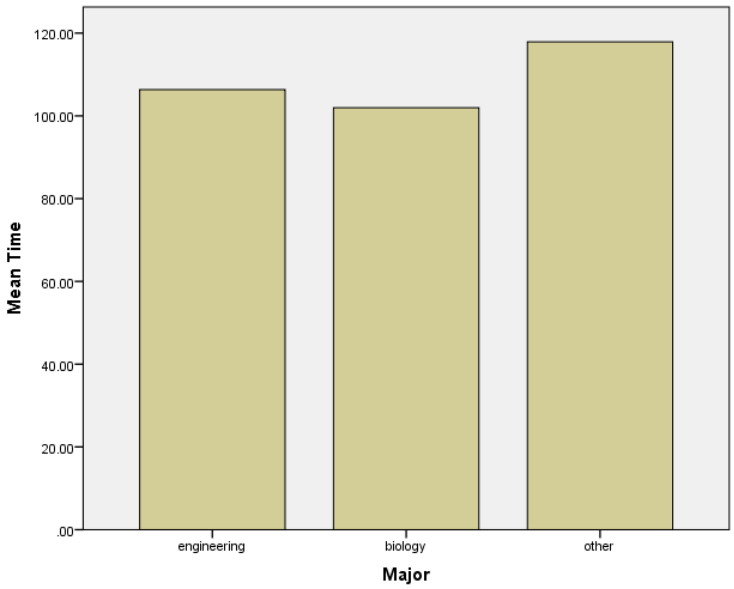

Figure 1. Overall Means.

A one-way analysis of variance (ANOVA) was calculated to assess whether change blindness score varies significantly according to a participant's indicated major. The findings were not significant, p =.253. Table 1 shows that the hypothesis regarding a student's college major affecting change blindness would not be supported by these results. The second hypothesis that regards gender and change blindness also is approaching significance but includes a small sample size and a varied standard deviation. The mean of the Males in the study had a time of 115.17 seconds as where the Females had a mean time of 108.76 seconds. The following data can be found in Table 2 below.

Table 2

Descriptive Statistics: Gender Sample Population

Gender	Mean	Std. Deviation	N
Male	115.1667	12.28685	6
Female	108.7556	18.88088	9
Total	111.3200	16.37660	15

A one-way analysis of variance (ANOVA) was calculated to assess whether change blindness score varies significantly according to a participant's indicated gender. The findings were not significant, $p = .478$.

The between- subjects analysis that was run to compare engineering, biology, and other majors and gender of the participants, the one-way analysis of variance (ANOVA) that was calculated to assess whether change blindness score varies significantly according to a participant's indicated major and the one-way analysis of variance (ANOVA) that was calculated to assess whether the change blindness score varies significantly according to a participant's indicated gender all were not significant.

Chapter 5

Discussion

Conclusions Regarding Sample Population

In testing change blindness and its relationship to college student's majors, each participant had to view a total of 10 images for 10 seconds and then again for 15 seconds. The participants were asked to explain whether or not they noticed any changes to the images or if it remained the same. If the participants did not notice any changes or did not find all of the changes to a particular image, they were given 15 seconds for that image. The slowest total reaction time would be 150 seconds in which the participants received 15 seconds for each image. Anything under 15 seconds would be considered to be a quicker reaction time. After each participant was tested, the totals were added up to compare the means among the various majors and genders.

After the data analysis was run, the results had shown that there was no significance between change blindness and college student's majors. No significant level was found in this sample size. Downing and Pinker (1985) studied change blindness to determine that attentional distribution or how we focus on the object in our visual field becomes an important variable when determining the presence of change blindness. Hollingsworth and Henderson (2002) found that the data suggests that relatively detailed visual information is retained in memory from previously attended objects in natural scenes. This research would launch further investigation of how our working memory use influences change blindness was respect to gaze, or the amount of fixation we spend on an object.

When considering the data of change blindness and college students' majors or any experiment revolving around change blindness, the variables of attention, working memory, orientation of the object, and masking the object become priority to the study. These variables have a strong relationship to change blindness and the evidence had shown that. Whether or not the images were stored properly in the participant's working memory or how much attention they gave to the study, these are the various factors to keep in mind when studying change blindness. However, the relationship between gender and change blindness was starting to approach significance for this sample size. The research of Forte, Mandato, & Kayson (1981) had found that gender is also an important variable to change blindness. In their study, the female participants were a lot quicker in their response times than their male counterparts. Also, Hamel and Ryan-Jones (1997) concluded that of greater interest was the hypothesis that visual detail would affect recognition; this hypothesis was only partially supported. With this being said, women performed better in this study because of how they processed the information. The data shows that women do perform better in this area due to their visual fields. The present study conducted showed that women were out performing their male counterparts even though it was a small sample size. In retrospect, the hypothesis dealing with females being quicker than males in response times showed validity for this study and previous research. The females in Biology had the quickest response times overall. If the sample size had included more females in Engineering, the results may have been different or remained the same. It is noted in the research of Malgwi, Howe, and Burnaby (2005) that aptitude in one's subject was the most important aspect of one's career selection. The participants chosen for this study may or may not have been heavily interested in their

field of study as well as this experiment. The significance of Peter and Umbach's (2006) work showed us that personality dictates a person decision on college major choice. However, there seems to be certain underlying characteristics of what draws an individual to a certain field. Research has shown us that college students whether in the field or not have their own personalities, behaviors, and personal drives in how they accomplish things. Therefore in considering this study, the variables of change blindness, gender, and one's personality or drive had played a role in the collection of this data.

Limitations

The major limitation to this study was the small sample size. Only 15 participants were recruited for this study which included 9 females and 6 males. Not having an equal amount of males and females in the study will skew reaction times based on what major the males or females fall under. Having a larger sample size and an equal amount of males and females would help to find more data on this topic. The larger population may show significant results for this study. Another limitation for this study may have been the images that were used. Participants may have struggle with the images or thought the images were too easy. The images could be considered a confounding variable in this experiment. Each participant was given an equal amount of time but may have not taken the study seriously. In conducting future research on this topic, the quality and quantity of the images should be investigated and taken into consideration. These images as well as the other implications for future research would help to uncover more data on this topic.

Further Directions

A few important implications for future research would include the images, the timing, and sample size. In conducting more research on this topic, a variety of images should be tested before they are used on participants. Trial runs would be very effective in collecting data. The quality and quantity of the images also should be tested. The 10 images selected in this study may not have been sufficient in collecting data. Using more images would equal more results. Another important implication to this study would be the timing. The participants were given 10 seconds to study each image and then another 15 seconds to note any changes. This may have not been enough time for the participants to study or notice any changes. In the future, participants should be given more time and maybe a pen and paper to write down their answers if necessary. The amount of time given to each participant is a major factor to this study. The relationship between the images used and the amount of time the participants were given for those images may yield different results every time. In order to find consistent and reliable results, a larger sample size must be used which is the last implication for future research. Expanding into a larger population of participants would yield more data on this topic. There is not a lot of previous research on this topic but if the work is replicated and studied in a larger sample, inconclusive results may be made conclusive.

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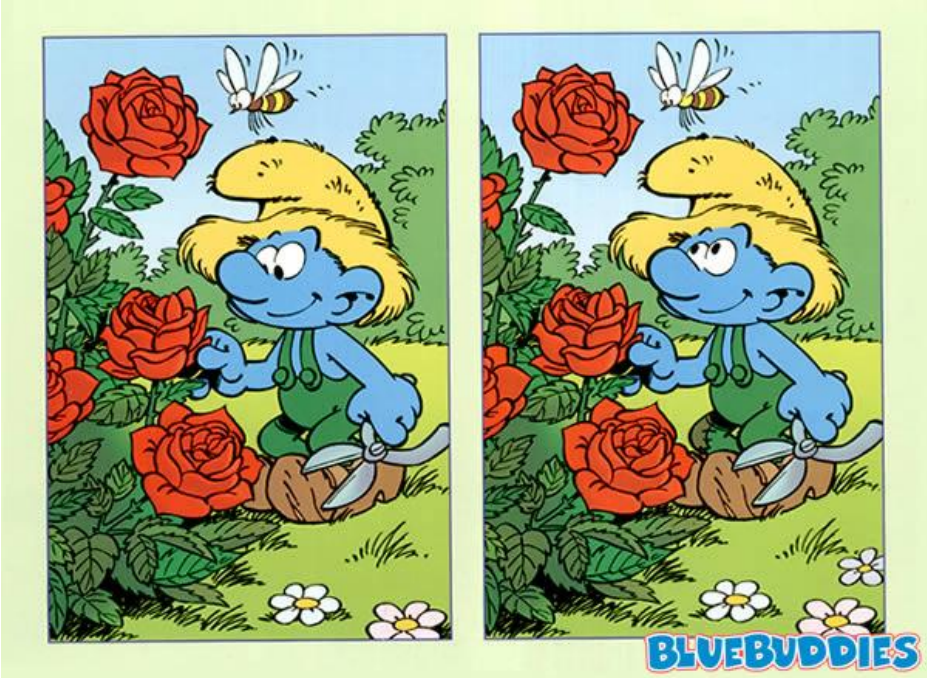
Appendix

Images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