HELPING IS GREEN, BUT JUSTICE IS RED:

THE INFLUENCE OF SYNESTHESIA ON EDUCATIONAL AND VOCATIONAL FOCI IN A COLLEGIATE POPULATION

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Julia Corinne Pruin

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Julia Corinne Pruin

Thesis Supervisor:

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Natalie Ceballos, Ph.D.
Department of Psychology

Approved:

_____

Heather C. Galloway, Ph.D.
Dean, Honors College

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Abstract

Synesthesia is a rare condition in which the senses of an individual are perceived to be combined, creating associations between various stimuli and sensations. To date, fifty-four types of synesthesia have been discovered, and objective tests exist for twenty of these (Eaglemen, 2007). While past research has been conducted on the underlying causes and influencers of synesthesia, little has been done to investigate the greater implications and applications that come with it. Synesthesia has been associated with heightened memory and enhanced learning, so it is not unreasonable to predict that a synesthete may develop prowess in certain skills associated with their type of synesthesia (e.g. a person with number-space synesthesia being better at mathematics or a person with personality-color synesthesia taking interest in sociology or psychology.) This study investigated the potential connections between synesthesia and educational and vocational interests in a sample of undergraduates from Texas State University. Two-hundred and eighty participants completed an online survey, which included questions about demographics, symptoms of synesthesia, and their educational and vocational interests (measured via the Holland Occupational Themes questionnaire [Holland, 1985]). In this sample, approximately 45% (127 participants) self-reported at least one symptom of synesthesia. Participants' data were examined using quantitative and qualitative methods. Results suggested that, in certain cases, experiences with synesthesia influenced participants' interests and career goals. The results of this study contribute to a greater understanding of a special group of people who experience the world differently. These findings may have broader implications for educational advisement and career counseling for synesthetes.

Helping is Green, but Justice is Red:
The Influence of Synesthesia on Educational and Vocational Foci in a Collegiate Population

The way in which we humans perceive the world around us is simultaneously individualized and standard. For example, as noted by Koch (2011), owing to the great similarities of our brains, we may all see the sun rise in the East, yet due to subtle differences in the wiring of our sensory and perceptual apparatus, the ways in which we *experience* a sunrise may differ. Some people, however, break the mold and experience the world in a truly unique way. These people have synesthesia, a psychological condition commonly described as the "mixing of the senses." Previously believed to be the result of drug use, or even some form of psychosis (Day, 2005), synesthesia entered the psychological literature as a real and natural perceptual phenomenon in the 1980's (Hochel & Milan, 2008). It is typically agreed upon within the research community that synesthesia is rare, but estimates of prevalence vary depending on the study, typically ranging from 1% (Rothen & Meier, 2010) to 5% (Spector & Maurer, 2011; Neckar & Bob, 2014).

The most common and most studied form of synesthesia is known as grapheme-color (Hochel & Milan, 2008; Spector & Maurer, 2011), in which letters and numbers are innately perceived to have a color (e.g. the letter "A" is red, the number "4" is blue, etc.). However, after further advancement in the field, there are thought to be well over 55 different forms of synesthesia (Day, 2008), all with different combinations of *inducers* (stimuli that trigger a response) and *concurrents* (extraneous perceived responses) (Hochel & Milan, 2008). There are also two different ways in which a synesthete can

experience concurrents: *projections* and *associations* (Dixon, Smilek, & Merikle, 2004). A projector experiences *photisms* (Dixon, Smilek, & Merikle, 2004) in the space in front of or around them. An associator, on the other hand, is described as experiencing associations in their *mind's eye* (i.e. innately *knowing* that Wednesday is green). The current study took into consideration five other types of synesthesia besides grapheme-color. These included color-time, space-time, sound-color, word-taste, and touch-smell. Color-time is similar to grapheme-color, in that color is the automatic concurrent perception, however, it is the days of the week or months of the year that are perceived as having color. Space-time is an example of a projector subtype, when a synesthete conceptualizes the days of the week and/or the months of the year to form an abstract shape. Sound-color, also known as chromesthesia, occurs when a person associates different notes and pitches of sound (especially in music) with different colors and can be either an association or projection subtype. Word-taste is described as different words inducing a gustatory response, and touch-smell occurs when a person experiences an olfactory response after being touched in different ways or by different textures.

Much of the early research on synesthesia was based on self-report data, which can be highly subjective and may be further skewed by the arbitrary associations that non-synesthetes might make that could resemble those with true synesthesia (Hochel & Milan, 2008). More recently, the two most prevalent ways of empirically testing for synesthesia are the Synesthesia Battery (Eaglemen et al, 2007; Carmichael et al, 2015) and the Stroop interference test (Stroop, 1992). The Battery relies on a common tenet of true synesthesia: consistency (Cytowic, 2002). For example, for a true synesthete who experiences grapheme-color associations, the number "2" might always be the same

shade of blue, distinguishable from all the other colors that might be associated with other graphemes. Non-synesthetes cannot reliably demonstrate this level of consistency, even if they developed synesthetic-like associations (Rich & Mattingley, 2002; Eaglemen et al, 2007). Stroop interference also plays off of this consistency, in that synesthetes who make color associations tend to require a greater length of time to identify an inducer if it is presented in a color different from the one that they typically see it as (i.e. a grapheme-color synesthete who normally sees the letter "Z" as yellow will take longer to recognize a "Z" in orange).

Alongside newer evidence that emerged with the development of empirical methods of testing for synesthesia, data have shown that synesthesia is congenital (Day, 2008) and familial (Simner et al, 2006), indicating that synesthetes may possess unique differences in brain structure that may be passed down to their offspring. Bosley and Eagleman (2015) suggest that expression of synesthesia may be influenced by environmental or epigenetic factors. Research into the regions of the brain involved in synesthesia began in the early 2000's (Witthoft & Winawer, 2013) and is still a matter of controversy. Several different parts of the brain are thought to involved in synesthesia, mainly due to the activation of regions adjacent to those normally involved in sensory processing (Neckar & Bob, 2014). Activated brain regions vary based on which inducers and concurrents are involved. For example, grapheme-color synesthesia is associated with abnormal activation of the parietal lobe (Spector & Maurer, 2011; Ward, 2015), however, other types might involve visual areas 4 and 8, the posterior inferior temporal cortex, the superior temporal gyrus, and the pre-frontal cortex (Neckar & Bob, 2014). The timing of synesthesia in the sensory-processing timeline is also up for debate, thus

creating a distinction between *higher* and *lower* synesthetes (Jäncke, 2013). Higher synesthetes are associated with more *top-down processing* (Jäncke, 2013) and exhibit differences in brain activity (compared to non-synesthetes) approximately 200ms after the presentation of a stimulus (Neckar & Bob, 2014). Lower synesthetes show differences in processing earlier (*bottom-up processing*), as reflected in differential brain activity 65-100ms after stimulus presentation (Jäncke, 2013).

More recent research has moved beyond detection of synesthesia to the examination of how synesthesia impacts the lives of synesthetes. Anecdotally, synesthetes have reported better memory and mental organization, which they attribute to their condition (Rich, Bradshaw, & Mattingley, 2005). This may be the result of synesthetic associations acting as mnemonic devices for synesthetes (Witthoft & Winawer, 2013; Watson et al, 2014). For example, a grapheme-color synesthete might excel at memorizing phone numbers or important names because they may remember color patterns that the numbers or letters create (Hochel & Milan, 2008). With this in mind, it is not unreasonable to predict that different types of synesthesia might improve related skills (i.e. someone with number-space synesthesia, who sees projected number-strings, may have more interest in and/or be better at math).

To date, the literature remains sparse with regard to the influence of synesthesia on academic skills beyond basic memory. However, many famous synesthetes have been musicians and artists, and there have been several claims that color-concurrent synesthetes are more creative (Rich, Bradshaw, & Mattingley, 2005; Rothen & Meier, 2010; Watson et al, 2014). Rothen and Meier (2010) compared the prevalence of synesthesia in undergraduate art students to the prevalence in unaffected controls. Using

consistency tests and a questionnaire, Rothen and Meier found a greater prevalence of grapheme-color synesthesia among art students. Their study marked a first step in the investigation of synesthesia's possible connections to synesthetes' interests and educational or career goals.

Previous research on synesthesia established tools for detecting the condition and laid the groundwork for more advanced studies of its long-term effects and implications. Researchers have begun to take steps to build upon the present foundation, to increase public awareness about the phenomenon, and to expand the psychological knowledge on the topic. Along these lines, the current study examined connections between different types of synesthesia and the educational and career interests of undergraduate students. The term *educational and career interests* was defined by the choice of major(s) that the students had chosen and their top Holland Occupational Theme (Holland, 1985). In this context, it was assumed that a student's major and activities of interest reflected their academic passions and the skills that they had put effort into cultivating. Data were collected using quantitative and qualitative methods to determine whether students with synesthesia felt their condition had influenced their educational activities and prospective career path. It was hypothesized that, given our society's emphasis on higher education, synesthetes' individualized experiences of reality might shape their cognitive lives beyond the mere ability to memorize birthdays and telephone numbers and that this influence would have a measurable influence on students' educational and career interests.

Method

Participants

Online survey data were collected from 278 undergraduate students from Texas State University. Participants were recruited through the PSY 1300 Introductory Psychology Research Experience and were compensated with class credit for their participation.

Measures

Demographics. Participants were asked to share basic demographic information to begin the survey (Appendix A). Of the respondents who reported experiencing synesthetic symptoms, 77.2% were female and the mean age of participants was 19.3 years (Standard Deviation = 1.3 years). In terms of racial category, the majority of participants were White (70.1%), and 60.6% of participants indicated that their ethnicity was Non-Hispanic.

Academic Characteristics. Following demographic questions, participants provided information about their grade classification by credit hours, whether they had previously attended another post-secondary educational institution, what their current undergraduate major(s) and minor(s) were, as well as, all past majors and minors (Appendix A). Approximately half of the participants (50.4%) were classified as freshmen by credit hours. The current majors were then classified by the academic colleges to which they belong at Texas State University. The eight colleges included Applied Arts, Business Administration, Education, Fine Arts and Communication, Health Professions, Liberal Arts, Science and Engineering, and the University College.

Synesthetic Experiences. Participants answered questions from the "Not Sure if You are Synesthetic" Questionnaire (Eagleman, 2005) in order to determine if they had experienced one or more of the six types of synesthesia described previously (Appendix B). Importantly, participants were asked to exclude any experiences that could be attributed to the use of mind-altering substances. Participants who responded *yes* to at least one of the symptoms of synesthesia were included in further analyses. The multiple-choice questions were followed by a free-response question asking for a description of any other synesthetic experiences they may have had which could not be attributed to the use of mind-altering substances. At the end of the survey, participants were asked if they felt that their reported synesthetic experiences had influenced their choice in undergraduate major and/or their future career goals.

Occupational Themes. In addition to the questions about academic majors and minors, a version of the Holland Occupational Themes questionnaire was used for this study. This questionnaire was made available by the Texas State University Career Services office and is free for use by all Texas State students, regardless of research participation (Holland, n.d.). The Holland questionnaire consists of 48 items describing various activities, each associated with one of six occupational themes: realistic, investigative, artistic, social, enterprising, and conventional (Appendix E). These themes are meant to give students an idea of what their interests are and what types of careers may be best suited to those interests (Appendix F). According to Holland (1985), being realistic is associated with enjoying "hands-on" work and mechanics. Investigative people tend to be interested in observation, creative thinking, and intellectualism. Being artistic is associated with being expressive and focusing on aesthetics, while people who

score highly in the social category tend to be more connected to working in groups and helping others. Enterprising types are described as ambitious and sociable, and conventional people are often drawn to data organization and stability in the workplace. For this study, participants selected activities from the Holland list which were of interest to them. The most commonly chosen activities were mapped onto one of the six Holland themes, and the most frequently chosen them was used for subsequent analyses. Using the Holland themes in addition to the participants' major accommodated individuals with interests suited to one academic college (e.g. College of Fine Arts and Communication), who may have chosen a different major (e.g., Finance) as a result of familial or societal pressure.

Statistical Analyses

Quantitative Approach. Descriptive statistics were calculated for the synesthetic group as a whole, followed by Chi-Square analyses to determine if distribution of synesthetic subgroups differed across the academic colleges or occupational themes.

Qualitative Approach. Content analysis was used to analyze the free responses provided by synesthetic participants about the influence of their condition on their choice of major and career goals. For those participants who answered this item, broad categories of responding included 1) No, synesthesia did not influence my plans, 2) Yes, synesthesia did influence my plans (with no further elaboration), and 3) Yes, synesthesia did influence my plans (with further elaboration). Participants' answers from the third category were further explored to identify themes.

Results

Quantitative

Background Characteristics of Synesthetes. From the total sample of 278 participants, 127 (45.7%) reported experiencing least one symptom of synesthesia. The mean age of onset for synesthetic symptoms was approximately ten years of age. Some participants reported that they had been experiencing synesthetic symptoms since birth. The latest age at which a participant reported realizing they had synesthesia was seventeen. Of those who endorsed symptoms of synesthesia, 83 (65.4%) reported having more than one kind with further details in Table 1. As shown in Table 2, the most common type of synesthesia reported in the sample was color-time (57.1%) and the least common was space-time (18.3%).

Table 1

Frequency of How Many Types if Synesthesia were Reported in Each Participant

Number of Types in One Participant	Frequency
1	44
2	40
3	25
4	10
5	6
6	2

Note. These numbers only reflect the six types of synesthesia that were specifically asked about in the "Not Sure if You're Synesthetic" Questionnaire (Eagleman, 2005). Subjects may have described having more types of synesthesia in free response questions.

Table 2

Frequencies and Percentages of the Different Types of Synesthesia Reported in the Sample

Type of Synesthesia	Frequency	Percent
Grapheme-Color	31	24.4
Color-Time	72	57.1
Space-Time	23	18.3
Sound-Color	44	34.6
Taste-Words	51	40.2
Touch-Smell	60	47.2

Academic Colleges. In terms of academic colleges reported by synesthetes, the majority of colleges at Texas State University were equally represented except for McCoy College of Business Administration and the University College, which were reported by only 3.9% and 1.6% of the participant sample, respectively. The most frequently identified college was the College of Science and Engineering (20.5%). Distributions of the synesthetic subgroups did not differ across any of the eight academic colleges.

Holland Scores. Approximately 59% of participants endorsed the social occupational theme. Less than 1% of the sample chose the conventional occupational theme. Distributions of the synesthetic subgroups did not differ across the six occupational themes.

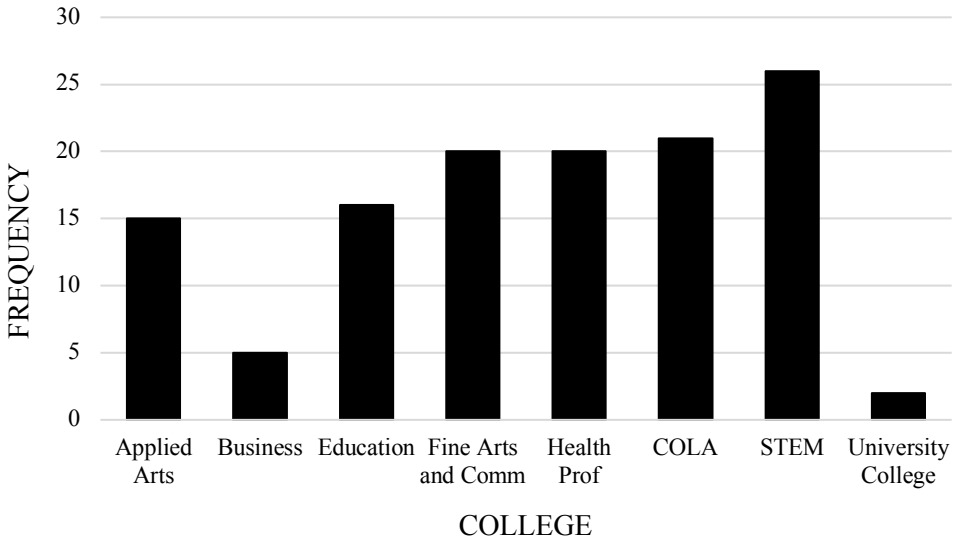

Figure 1. Synesthetes' Majors, Grouped by Academic College

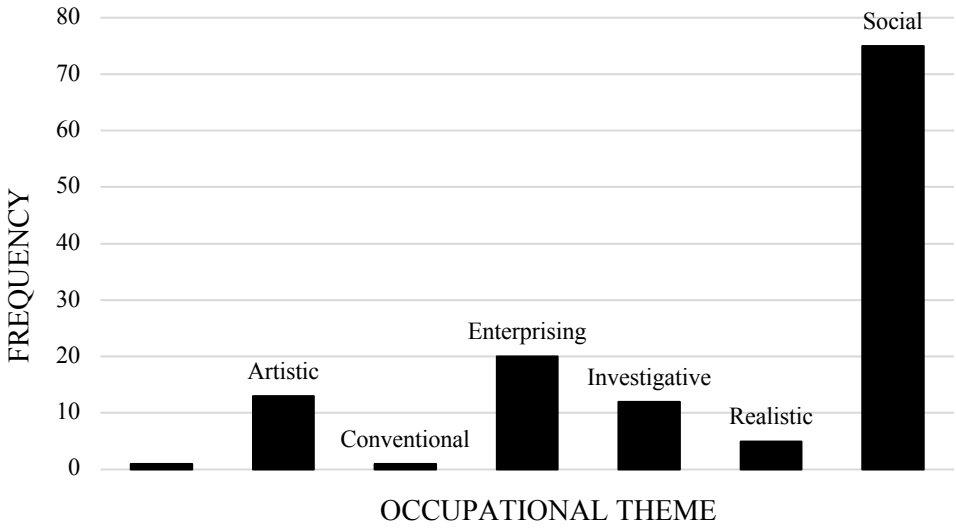

Figure 2. Synesthetes' Holland Scores

Qualitative

Academic Major. Of the 127 respondents of the survey, 41 did not provide any answer to the free response question concerning the perceived influence of their synesthesia on their choice of major. Forty-one participants felt that their synesthesia had no influence on their major, and 17 provided ambiguous responses. These answers ranged

from simple responses such as “I like helping people” and “love for diet” and could not reliably be considered an affirmative or negative answer without further context. Ten participants provided the answer “Yes,” but did not offer any further elaboration. Eighteen participants responded that, yes, they did feel that their synesthesia had influenced their major and also provided an explanation as to how.

Common themes that emerged from the affirmative answers with explanations included synesthesia helping with visualization of information (four mentions), the importance of colors (seven), and the desire to help others (five). Example responses from the data that were most explicit in their explanations are included in Appendix C, along with the respondent’s major and reported types of synesthesia.

Career Path. Of the 127 respondents of the survey, 43 did not provide any answer to the free response question concerning their perceived influence of their synesthesia on their choice of future career. Forty participants felt that their synesthesia had no influence on their major, and 16 provided ambiguous responses. Unclear responses to this question included “little brother being born” and “interest in building things.” As with the free responses concerning academic major, these could possibly be synesthetic associations from the participants; however, the responses could not be categorized with any certainty. Fourteen participants provided the answer “Yes,” but did not offer any further elaboration. Fourteen participants responded that, yes, they did feel that their synesthesia had influenced their career goals and also provided an explanation as to how.

The most common theme that arose from the set of responses with explanations referred to color associations (6 responses). The two less commonly found themes, with

only two responses for each, were associations with movement and a desire for experiences that stimulate pleasurable synesthetic experiences. Example responses from the data collected, pertaining to this question, can be found in Appendix D and include the respondent's major and all the types of synesthesia they reported having.

Discussion

Despite more recent efforts to understand synesthesia, much remains to be discovered. Synesthesia is a highly variable and individualized condition; it is difficult to make generalizations and define rules around it. Different inducers and concurrent sensations (Hochel & Milan, 2008) implicate distinctive parts of the brain (Neckar & Bob, 2014). Higher and lower synesthetes go through sensory processing at different times (Jäncke, 2013) and projectors and associators visualize photisms in independent ways (Dixon, Smilek, & Merikle, 2004). The endless combinations between these characteristics complicate research on this topic, but this may also be what gives synesthetes a personalized edge when it comes to memory and learning. While studies have found little conclusive evidence on whether synesthesia actually improves learning, synesthesia does appear to provide a different path to master the same skill (Watson et al, 2014). However, because this alternative method is built in, it may come more naturally to a person, or personally prove to be easier to learn than more conventional methods.

Researchers who study synesthesia are largely in agreement that study of the relationship between synesthetic perception, memory, and learning remains underdeveloped (Watson et al, 2014). This scantiness of theliterature has largely been attributed to the relative novelty of the field in general (Watson et al, 2014), as well as, the reliance on self-report for much of the data collection (Witthoft & Winawer, 2013).

This thesis project was an attempt at a new approach to the study of the relationship between synesthesia and learning. Rather than targeting the synesthetes' perception of their own learning, the current study was designed to investigate the long-term effects of any prior enhanced learning. There are many different types of synesthesia and, as a result, various ways that synesthesia may (or may not) help someone learn (Lunke & Meier, 2018). Based on previous literature it was predicted that, if synesthesia helps improve memory and learning in those who have it, then undergraduate students might choose academic majors and career paths that reflect these enhanced skills. Quantitative analyses failed to yield significant results; however, qualitative analyses of free responses were more revealing.

The most common theme from both the questions about choice of academic major, and career path was the importance of colors. These findings are consistent with previous studies showing that color is the most common concurrent response across all known types of synesthesia (Hochel & Milan, 2008). However, in contrast to previous reports (Rich, Bradshaw, & Mattingley, 2005; Rothen & Meier, 2010; Watson et al, 2014), colors were not always found to be directly aligned with creativity in the current project. While there were certainly references to art and *making* in the responses (Appendix C, R2 & R4; Appendix D, R1 & R4), there were also references to the association between colors and emotions or actions, and the use of color as validation (Appendix C, R5 & R6; Appendix D, R3 & R5). Another common theme among the responses to questions regarding academic major was the usefulness of synesthesia in visualization. This phenomenon (synesthesia as a useful method of visualization) is a relatively well-documented occurrence (Watson et al, 2014). In the current study, this

association appears as a method of remembering anatomy (Appendix C, R3) and creating computer programs (Appendix C, R1), which were identified as being helpful in the participants' choices of academic major (i.e. Biology and Computer Science, respectively). The negative responses to each question were enlightening when attempting to understand the limits that synesthesia has when competing with environmental factors. For example, some of the reasons given for why participants did not feel that they were influenced by their synesthesia often referenced something that held greater sway over them instead, such as money or family pressure.

Another interesting aspect of the current findings was the unusually high number of synesthetes who were identified from the modest sample of 278 participants. There have been claims that synesthesia affects one in every four people in the general public (Simner et al, 2006), however, more typical estimates place the incidence of synesthesia at closer to 5% (Spector & Maurer, 2011; Neckar & Bob, 2014). In addition, an usually large number of participants endorsed more than one kind of synesthesia, which was also a novel finding compared to the existing literature (Hochel & Milan, 2008). These elevated frequencies in the current sample may be due to the means of convenience sampling used for the study. Participants were recruited from a psychology course that includes the topic of synesthesia, so it is possible that if someone suspected that they were experiencing uncommon cognition or perception, they may have been more likely to take a course that could potentially explain what is happening to them. It must be restated that empirical testing was not used in this study, so it is likely that the true frequencies of diagnosable synesthesia may be much lower. Further discussion of the importance of empirical testing appears in the Limitations section.

Limitations

The current project was limited by several barriers which are faced by any study of synesthesia. The greatest of these barriers was the relative unfamiliarity of synesthesia among the general public. Many people have never heard of the condition, and even those who have it may not always realize that what they experience is unique in any way. The survey used in this study contained a brief, one-line description synesthesia, which may not have provided enough context for some participants to understand the full purpose of the study.

Further, analyses in the current study focused on only the top Holland choice for each participant. In their typical form, Holland scores include two numbers that denote the top two occupational interest themes of a participant. Many cases also included a tie between the top two themes and many others were very close, so simply picking the first number may have led to a loss of nuance that would have otherwise been provided. It may also be noted that there was a disproportionately large number of participants in this sample who chose social as their top theme. This unequal distribution of career themes could be attributed to the age of participants and the college environment. Ages in the sample ranged from 18 to 23 years with the majority of respondents being in the first semester of their first year of college. It is logical to suggest that many emerging adults in the university setting may be more invested in being social, rather than pursuing conventional or realistic interests.

The significant degree of overlap between course groupings for different majors might have presented another confounding factor. For example, the Exercise and Sports Science (ESS) degree plan includes courses that would most often be associated with the

College of Science and Engineering. However, ESS is housed in the College of Education at Texas State University. In fact, the majority of participants from that academic college were enrolled in the ESS degree plan. The generalizability of the current findings may also have been affected by the recruitment of participants from the Department Psychology, which is housed in the College of Liberal Arts at Texas State, but may be located in the College of Science, or even the College of Health Professions, at other universities.

The final barrier that had to be overcome in conducting this study was the lack of empirical testing. Ideally, participants identified based on their self-reported symptoms of synesthesia would have had their condition verified through empirical testing for example, using the Synesthetic Battery (Eaglemen et al, 2007; Carmichael et al, 2015). Further testing, and an in-person interview with participants, would offer more weight to claims of having synesthesia and would provide researchers with a greater opportunity to glean specifics about the impact of synesthesia on the lives of synesthetes.

Future Directions

Future studies should include empirical verification of synesthesia in addition to providing participants with a more thorough explanation of the condition, perhaps using visual, auditory, and/or tactile examples. These methodological considerations might enrich participants' responses to the open-ended questions (Appendix B). Taking this new approach to the study of learning in synesthetes could offer an alternative way to investigate the impact that synesthesia might have on learning. By working backwards to identify which types of synesthetes may be most likely to experience positive effects from their condition, researchers might more readily distinguish the ways in which

synesthesia helps to improve learning, and further characterize the long-term ramifications of this facilitation. By shifting focus to the long-term implications of learning with synesthesia, further research could be conducted on the practical applications of synesthesia in the context of school and academics at all levels.

For students with synesthesia, earlier identification of their condition could be the first step in helping them hone their academic skills. Synesthetes already report the natural formation of mnemonic devices due to their innate associations (Hochel & Milan, 2008; Witthoft & Winawer, 2013; Watson et al, 2014), so intentional training for synesthetes could potentially increase the likelihood of memory facilitation. Already, studies have begun to investigate similar hypotheses. A project by Hughes et al. (2019) attempted to train people with sequence-space synesthesia to have the savant skill of calendar calculating, and the researchers have reported promising preliminary results. This approach could lead the way to purposeful interventions with young synesthetes, in order to direct them towards academic interests and career paths, which could be facilitated by their synesthesia.

Could synesthesia be *taught* to non-synesthetes? If reliable links can be found between different types of synesthesia and improvement of related skills, then synesthetic accounts could reveal exactly what makes math easier for a number-space synesthete or reading easier for someone with lexical-color synesthesia. With this knowledge in mind, new tutoring methods could be developed to teach alternative ways of learning to non-synesthetes who struggle in the more traditional classroom. Non-synesthetes have been mistaken for true synesthetes in the past, due to reports of synesthetic-like associations (Hochel & Milan, 2008). In fact, these mistakes were one reason that establishing

empirical tests for synesthesia was a priority in the early days of research in this field (Day, 2005; Johnson, Allison, & Baron-Cohen 2013). More recently, researchers have begun to explore the practice of "teaching" synesthesia to people who do not have it naturally (Rothen & Meier, 2014). To date, attempts have been made to teach individuals to make synesthetic connections (Bor et al. 2014) in order to learn music and to deal with visual impairment (Kuo & Chuang, 2013; Renier & Volder, 2013).

Conclusion

This study investigated the potential relationship between different forms of synesthesia and the academic majors and career paths of undergraduate students at Texas State University. Overall, responses to the open-ended questions pertaining to career and major were the most compelling. Some responses strongly confirmed the study hypotheses, for example, that someone with number-space synesthesia would be better at math. These findings, while limited, add an interesting new perspective on synesthesia and its effects on cognition and behavior. This study could prove to be a significant step forward in exploring the full extent to which to synesthesia is capable of affecting both those who have the condition, and potentially, even those without it.

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Appendix A

Demographic and Self-Report Questions

1) What is your age?
2) What is your race?
3) What is your ethnicity?
4) Have you previously attended a different form of higher education, before enrolling in a four-year university? (i.e. community college, trade school) If yes, specify which kind.
5) Current undergraduate classification: _____
6) Current undergraduate major(s): _____
7) Have you ever changed your major? If yes, please list all past majors:
8) Current minor(s): _____
9) Have you ever changed your minor? If yes, please list all past minors:
10) In your own words, please tell us if you think that your sensory experiences might have influenced your preferences for college major.
11) In your own words, please tell us if you think that your sensory experiences might have influenced your preferences for a future career.

Appendix B

"Not Sure if You are Synesthetic?" Questionnaire

Please indicate your responses to the questions below

Do numbers or letters cause you to have a color experience? Example: Does the letter J "mean" yellow to you? Or does "5" make you perceive purple?

- ○ Yes, I have had similar experiences
- ○ No, I have not had such experiences

Do weekdays and months have specific colors? Example: Does July always mean Navy Blue to you? Is Wednesday always orange?

- ○ Yes, I have similar associations
- ○ No, I do not have such associations

Do you imagine or visualize weekdays, months and/or years as having a particular location in space around you? Example: Is September always located two feet in front of you to the left?

- ○ Yes, I have always felt these specific spatial locations
- ○ No, I have never had this kind of association

Does hearing a sound make you perceive a color? Example: Does a shrill car horn cause you to see the color green? Does C sharp make you see pink?

- ○ Yes, I do have such experiences
- ◉ No, I have not had such experiences

Do certain words trigger a taste in your mouth? Example: Does the name 'Derek' taste like earwax?

- ○ Yes, this is familiar to me
- ○ No, I have never felt like this

Do you feel a sense of touch when you smell things? Example: Does the smell of coffee make you feel as though you are touching a cold glass surface?

- ○ Yes, I have had such experiences
- ○ No, this doesn't happen with me

We have described a few types of synesthesia. Many other unusual blendings of the senses have been reported. Do you suspect that you experience an unusual blending that other people do not have (other than the ones listed above)? These could include automatically hearing a sound when you see movement, or the sense of a shape being triggered by a taste, or experiencing a color when feeling pain.

- ◉ Yes, I believe I may have other forms of unusual sensory experiences
- ○ Not that I know of

Appendix C

Free Response Answers

Question: In your own words, please tell us if you think that your sensory experiences might have influenced your preferences for college major.

Response 1, Computer Science: Yes, because one of the sensory experiences I have is visualizing the days of the week. Since I am a computer science major, this helps me visualize advanced math I have to do in classes or writing a program. (Grapheme-Color, Time-Space, Taste-Words)

R2, Psychology: Chromesthesia built my passion for music. I feel more tied to sounds, since I'd visualize the notes being played, as certain colors. It helped immensely in choir, when told to sing with a "warm, orange" or "bright, yellow" voice, which translated to "using your head voice, and not chest-voice". (Grapheme-Color, Sound-Color, Taste-Words, “Hearing rain results in a cold bodily sensation. Hearing fire crackling, produces warm temperature sensations.”)

R3, Biology: I feel that thinking spatially allows me to organize information efficiently. It’s also easy for me to understand anatomy because I can look at it in my head. (Grapheme-Color, Color-Time, Space-Time, Sound-Color, Touch-Smell)

R4, General Studies: I’m doing art as a minor so yes (Color-Time, Taste-Words)

R5, Biology: The feeling of helping people is related to green and that makes me want to continue doing it. (Color-Time, Sound-Color)

R6, Criminal Justice: My sensory experiences such as seeing a crime occur or victims of a crime, it gives me the sense of the color red and the image in my mind of someone

doing justice. (Grapheme-Color, Color-Time, Sound-Color, Taste-Words, Touch-Smell, "Color with pain, voice with smells")

Appendix D

Free Response Answers

Question: In your own words, please tell us if you think that your sensory experiences might have influenced your preferences for a future career.

Response 1, Psychology: Absolutely. Either being a singer or coordinating the light show. Certain colors should be flashed, or dimmed at certain parts of a song, as they'd complement each other, from my perspective. (Grapheme-Color, Sound-Color, Taste-Words, “Hearing rain results in a cold bodily sensation. Hearing fire crackling, produces warm temperature sensations.”)

R2, Exploratory Professional: I believe that because I do associate physical movement with feelings and emotions that I won’t be able to ever work a true desk job. (Color-Time, Time-Space, Word-Taste)

R3, Biology: The feeling of helping people feels like green and green is good, so I want to be a doctor. (Color-Time, Sound-Color)

R4, Mass Communication and Public Relations: I like the use of color and how it appeals to others, so I went for a major that I can use a lot of marketing and designing techniques (Grapheme-Color, Time-Color, Sound-Color, I think of school subjects as colors)

R5, Nursing: I believe so because in a way I find working in a hospital is intriguing especially because they coordinate many things with colors and the different things you hear in that atmosphere I correlate with other things as well. (Color-Time, Sound-Color, Word-Taste)

Appendix E

Holland Occupational Themes Questionnaire

Select any item in the list below that is appealing to you. Leave the rest blank.

1. Farming
2. Advanced math
3. Being in a play
4. Studying people in other lands
5. Talking to people at a party
6. Word processing
7. Auto mechanics
8. Astronomy
9. Draw or paint
10. Go to church
11. Work on a sales campaign
12. Use a cash register
13. Carpentry
14. Physics
15. Foreign language
16. Teaching children
17. Buying clothes for a store
18. Working from nine to five
19. Setting type for a printing job
20. Using a chemistry set 21. Reading art and music magazines
22. Helping people solve personal problems
23. Selling life insurance
24. Type reports
25. Driving a truck
26. Working in a lab
27. Musicians
28. Making new friends
29. Leaders
30. Following a budget
31. Fixing electrical appliances
32. Build rocket model
33. Creative writing
34. Attending sports events 35. Being elected class president
36. Using business machines
37. Building things
38. Doing puzzles
39. Fashion design
40. Belonging to a club
41. Giving speeches
42. Keeping detailed records
43. Wildlife biology
44. Being in a science fair
45. Going to concerts
46. Working with old people
47. Sales people
48. File letters and reports

Scoring

R = REALISTIC 1 7 13 19 25 31 37 43

I = INVESTIGATIVE 2 8 14 20 26 32 38 44

A = ARTISTIC 3 9 15 21 27 33 39 45

S = SOCIAL 4 10 16 22 28 34 40 46

E = ENTERPRISING 5 11 17 23 29 35 41 47

C = CONVENTIONAL 6 12 18 24 30 36 42 48

Appendix F

Further Clarification of Holland Occupational Themes

Occupational Theme	Common Traits	Examples Activities
REALISTIC	Enjoys outdoor activities, excels at hands-on work, socially and politically conventional	Farming, Carpentry, Wildlife Biology
INVESTIGATIVE	Prefers independent work, introspective and intellectual, work-focused	Astronomy, Working in a lab, Doing Puzzles
ARTISTIC	Enjoys creative arts, emotionally sensitive, unique and expressive	Foreign language, Creative writing, Going to concerts
SOCIAL	Works well in groups, helpful and friendly, responsible	Teaching children, Making new friends, Attending sports events
ENTERPRISING	Strong and persuasive leaders, ambitious and self-confident, values material wealth	Giving speeches, Talking to people at a party, Work on a sales campaign
CONVENTIONAL	Structured and organized, conscientious and practical, prefers clear instruction	Working from 9-5, Type reports, Following a budget

Note. Descriptions of common traits are adapted from Holland Occupational Themes by Holland, n.d. Retrieved from www.careerservices.txstate.edu/students/counselingappointment/assessments