

Fall 2017

A Colorful World: Synesthesia's Effect on Creativity Through Firsthand Abstract Representations of Grapheme-Color and Ordinal-Linguistic Personification

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A COLORFUL WORLD: SYNESTHESIA'S EFFECT ON CREATIVITY

A Colorful World:
Synesthesia's Effect on Creativity Through Firsthand Abstract
Representations of Grapheme-Color and Ordinal-Linguistic
Personification

A Thesis Submitted to
The Faculty of the University of North Georgia
In Partial Fulfillment
Of the Requirements for the Degree
Bachelor of Science in Psychology
With Honors

Diana Knight
University of North Georgia

Fall 2017

Accepted by the Honors Faculty
of the University of North Georgia
in partial fulfillment of the requirements for the title of
Honors Program Graduate

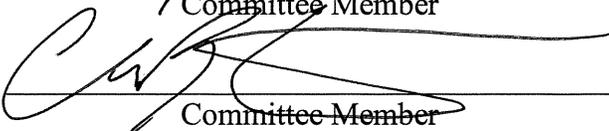
Thesis Committee:



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Committee Member



Honors Program Director

A Colorful World: Synesthesia's Effect on Creativity through Firsthand Abstract Representations of Grapheme-Color and Ordinal-Linguistic Personification

Synesthesia, a perceptual phenomenon that occurs in about 5% of the population, is characterized by the involuntary expression of a stimulus through association with another stimulus, usually in another sense, such as associating purple with the letter "A" (Yon & Press, 2014). There are several different forms of synesthesia, involving every combination of every sensory modality. Spector and Maurer (2013) found that the most common forms of synesthesia include grapheme-color synesthesia, in which graphemes such as letters and numbers induce a specific color, and time-space synesthesia, in which weekdays, months, etc. occupy a specific space either inside the synesthete's mind or outside their body. These forms of synesthesia can be categorized in several ways, from their function to their onset of symptoms. Rogowska (2011) refers to one particular category of synesthesia pertaining to associational, artistic synesthesia. Famous painters, writers, and other artists such as painter Vassily Kandinsky and novelist Vladimir Nabokov have reported synesthetic-like experiences, which has led to the study of the relationship between synesthesia and creativity (Mulvenna, 2007). Synesthesia and its effect on creativity holds an interesting topic of study, as understanding the link between synesthesia and creativity may reveal aspects of synesthesia such as its possible causes and whether it can benefit individuals.

History of Research on Synesthesia

The scientific study of synesthesia first emerged in the 1800s, although musicians and philosophers had explored the subject centuries prior (van Campen & Froger, 2003). The first scientific explorations involved case studies. Researchers often used self-report to understand

synesthesia qualitatively (van Campen & Froger, 2003). The behaviorist movement caused a decline in synesthetic research, as there became more of an emphasis on systematic study of human behavior rather than subjective, internal experiences. Synesthetic research did not regain popularity until the 1980s with the introduction of neurological methods, which allowed synesthesia to be studied more objectively, rather than relying on self-report (van Campen & Froger, 2003). American Richard Cytowic and Englishman Simon Baron-Cohen became the predominant neurologists to delve into the physiological basis of synesthesia (Dutton, 2015).

Theories of Synesthesia

Two primary theories exist to explain the cause of synesthesia. First, cross activation theory states that synesthesia arises from inadequate synaptic pruning, resulting in overstimulation between modalities (Mikus, 2013). Overabundance of synapses between two senses would lead to more plasticity and connectivity between communications. Mikus (2013) further outlines a second theory, called disinhibited feedback theory, which states that stimuli travelling from early to late processing do not get properly inhibited and travel backwards, re-stimulating earlier processing again. Spector and Maurer (2013) introduced a new hypothesis for the cause of synesthesia that integrates the cross activation and disinhibited feedback theory. This new theory states the senses are intertwined in synesthetes, and are similarly intertwined in everyone at birth. As pruning and inhibition occur in non-synesthetic individuals, these experiences may become exaggerated in synesthetes. This hypothesis helps explain why certain cross-modal associations are similar in synesthetes and non-synesthetes alike. For example, those with grapheme-color synesthesia often identify certain letters as having the same color as non-synesthetes, like "R" is red and "O" is white (Simner et. al, 2006).

Types of Synesthesia

Different forms of synesthesia exist in every combination of cross-modal association, and can be categorized many ways. Experiencing one type of synesthesia makes an individual 50% more likely to experience another type of synesthesia, which is referred to as “polymodal” synesthesia (Cytowic & Eagleman, p. 23). While some studies find grapheme-color synesthesia as the most common, others find colored-hearing to be the most common (Ione & Tyler, 2003; Spector & Maurer, 2013). Rogowska (2011) outlines eleven categories of synesthesia.

Constitutional, or developmental synesthesia, is characterized by being present from early childhood, or as long as the individual can remember, while acquired synesthesia occurs during adulthood, resulting from accidental or disease-related injury (Rogowska, 2011). Phantom synesthesia results from strong perceptual connections causing the subject to experience pain in appendages that have been previously amputated (Rogowska, 2011). Some forms of synesthesia result in overstimulation of empathy and mirror perceptions, such as the individual feeling a tingling sensation on their cheek when watching another individual get slapped across the face (Rogowska, 2011). Artificial synesthesia is voluntary and self-taught, typically used to improve performance on memory tasks (Rogowska, 2011).

Temporary forms of synesthesia include virtual, narcotic, and hypnosis-induced synesthesia. Virtual synesthesia is briefly induced associations arising from participating in a computer-simulated virtual reality (Rogowska, 2011). Some individuals experience synesthesia for a short time while hypnotized, and these experiences can even persist after they've been awakened from hypnosis (Rogowska, 2011). Narcotic synesthesia is another temporary form of

synesthesia that can be experienced while under the influence of LSD or other psychoactive drugs (Rogowska, 2011).

Many types of synesthesia have a basis in how we learn language during development. Neonatal synesthesia refers to the first four months of life when individuals have synesthetic experiences (Rogowska, 2011). This phenomenon is thought to be the foundation for synesthesia that carries into adulthood. Weak synesthesia refers to the type of synesthetic experiences that are common to everyone, such as associating high-pitched sounds with bright colors and low-pitched sounds with dark colors, or associating certain colors with one gender or another (Rogowska, 2011).

Categorization of the different types of synesthesia helps further understanding by displaying the various ways synesthesia manifests, as well as aid in efficiency of categorization when new types of synesthesia are discovered.

Diagnostic Criteria for Synesthesia

In order to differentiate synesthesia from other phenomena, as well as maintain reliability and validity in findings, studies use a set of diagnostic criteria to establish if someone experiences synesthesia. Synesthesia is primarily defined as an automatic, involuntary experience; the individual makes these associations without trying (Mikus, 2013).

This automacy can involve certain perceptions standing out from others, called the “pop-out effect” (Mikus, 2013; Rich, 2013). For example, an Embedded Figures Task involves showing the individual a plane full of graphemes of seemingly the same letter or number, and asking the individual to find the hidden graphemes (Fig. 1). Say the plane appeared to be nothing but the number five, and the individual was asked to find the number two's scattered in the

plane. Researchers speculated that synesthetes would experience a pop-out effect and be able to find the two's faster than a non-synesthete.

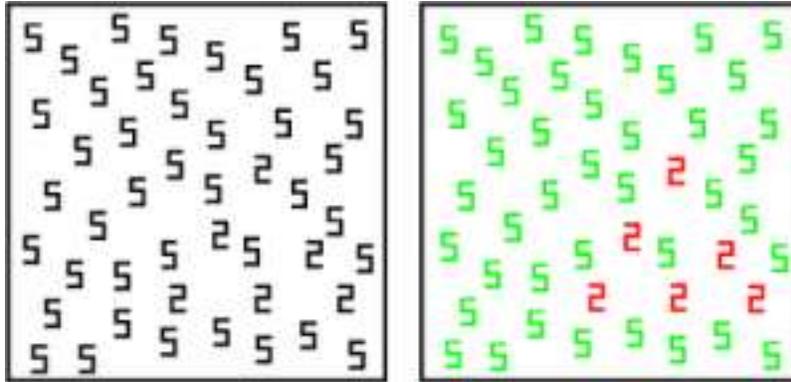


Figure 1. Embedded Figures Task (from Ramachandran, 2001).

Surprisingly, studies have shown that when using the Embedded Figures Tasks, synesthetes did not have significantly faster reaction times than nonsynesthetes, but did exhibit higher accuracy in identifying the less frequent grapheme (Rich, 2013. Edquist, Rich, Brinkman, & Mattingley, 2006). These results can be explained because synesthesia occurs in later visual processing, meaning the grapheme must be attended to in order to elicit a stimulus (Cytowic & Eagleman, 2009).

Palmeri, Blake, Marois, Flanery, & Whetsell (2002) give another example of the importance of attention on synesthetic output through their study using local versus global stimuli. Essentially, when synesthetes are given a local and global stimulus that evoke different colors, the colored percept depends on which stimulus is given attention (Fig. 2).

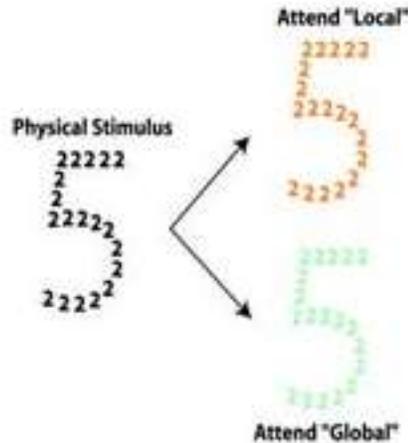


Figure 2. Local vs. Global Stimulus (from Palmeri et. al, 2002)

Synesthesia is also defined by its consistency and simplicity. Although non-synesthetes may give similar answers to synesthetes when prompted to give a grapheme an associated color, consistency in their answers differs greatly between the two groups. One study found that after retesting a year later, synesthetes showed 92% consistency in their answers, while only a week later, non-synesthetes were 38% consistent in their answers (Spector & Maurer, 2013). With synesthetic experiences involving shapes, the shapes are often simple and flat; to experience otherwise may categorize the experience as more of a hallucination than a synesthetic experience (Mikus, 2013).

Furthermore, synesthesia is defined by its evocation of emotion, or affect. Experiencing the associated stimulus brings about short but powerful emotion in a synesthete (Mikus, 2013). These emotions lead to synesthetes believing their perceptions are nothing but genuine, with stronger associations or synesthetic experiences often corresponding to stronger emotional connection (Mikus, 2013). Synesthetes find pleasure in correctly corresponded stimuli and discomfort or irritation in incorrectly corresponded stimuli (Cytowic & Eagleman, 2009).

However, synesthetes often enjoy having these extra-sensory experiences, even when occasional discomfort occurs (Cytowic & Eagleman, 2009).

Common Traits in Synesthetes

Although synesthesia can be found in every racial, economic, and cultural background, synesthetes do share some characteristics. Cytowic (2002) states that synesthesia often runs in families, and synesthetes are commonly left-handed, highly intelligent, have better than normal memories, and are often more creatively inclined (Cytowic, 2002). However, synesthetes share some negative characteristics as well, such as struggling with quantitative reasoning tasks, and a deficient sense of direction (Cytowic, 2002). Synesthesia is also found to be more common in individuals with Autism Spectrum Disorder, dyslexia, and attention-deficit disorders (Baron-Cohen et. al, 2013. Cytowic, 2002). Before objective tests were created, studies on synesthesia relied heavily on self-report. Therefore, synesthesia was thought to affect 0.05% of the population and occur more often in women than in men. Simner et. al (2006) found through objective testing that synesthesia is much more common than previously thought, affecting 4-5% of the population, and found no gender differences.

Synesthesia and the Artist

Sculptors, graphic designers, poets, novelists, musicians, and practically every division of artistic expression has or is speculated to have a famous synesthete. One commonly discussed synesthete is Vassily Kandinsky, a painter and color theorist. In "Concerning the Spiritual in Art", published in 1977, Kandinsky outlines the interplay between different colors and shapes in evoking specific emotions from observers (Fig. 3). For example, Kandinsky's ideas on the language of form and color state that the color yellow spreads out from its center, moving

towards the observer, while the color blue moves in on itself, moving away from and alienating the observer (Kandinsky & Sadleir, 1977; Fig. 3).

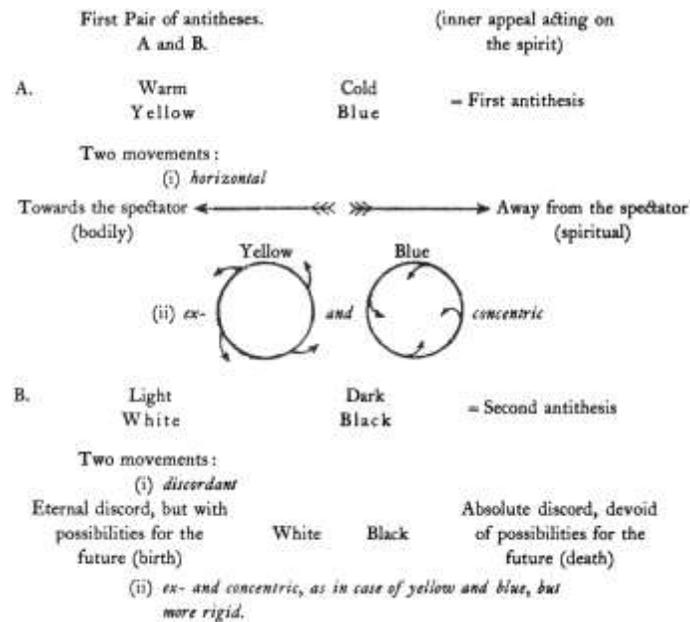


Figure 3. Kandinsky's ideas on color relationships (from Kandinsky & Sadleir, 1977)

Another well-known synesthetic artist, Carol Steen, began her artistic career in the 1960s without knowing the true inventiveness of her own work (Steen, 2001). Three decades after beginning her career, Steen discovered she had synesthesia, and reflecting on her past works, realized the inspiration for her paintings and sculptures had come from her synesthetic experiences (Steen, 2001). According to self-report, Steen (2001) has several forms of synesthesia, often pertaining to seeing colors and shapes induced by touch or sound. Steen's paintings often capture a very specific sound at a particular moment in time, such as her painting *Michael at Wolf Howl Pond*, meant to depict what Steen saw in her mind's eye as she heard one of her friend's howl (Steen, 2001). Her sculpture *Cyto* is named after neurologist Richard Cytowic, whom she heard speaking on the radio about synesthesia, which opened her eyes to this phenomenon (Steen, 2001, Fig. 4).



Figure 4. Carol Steen's *Cyto*, inspired by Richard Cytowic (from Steen, 2001)

In the music realm, Olivier Messiaen, a composer from the early 20th century, is a commonly speculated synesthete. Messiaen developed a mode of categorizing sounds using mathematics and internal reasoning, as well as complementing music with colors (Cytowic, 2002). Messiaen's theories on sound categorization, interpreting music through color, and his descriptions of colors and locations of the sounds in his pieces has led to the belief that Messiaen was a synesthete (Cytowic, 2002).

Synesthesia and Creativity

With colorful experiences happening in a synesthete's everyday life, it stands to reason that synesthetes would have an affinity towards, and a higher capacity for the creative arts. Studies have found some evidence to support this hypothesis. Cheng, Hu, Jia, & Runco (2016) explain that creative people are found to have lower cognitive inhibition. In their study of the correlation between higher and lower cognitive inhibition in creative problem finding abilities, Cheng et. al (2016) found that low cognitive inhibition was only beneficial in early problem

finding, whereas high cognitive inhibition aided in later problem finding. In other words, creative individuals take in excessive stimuli in the early stages of working through problems, then narrow their thinking later. These results suggest that a combination of early, associative strategies and later, creative strategies are used in problem finding. This study, in the context of disinhibited feedback theory, implies that there could be a relationship between creative success and synesthesia.

A 2008 study found that synesthetes were more likely to engage in creative activities, especially activities that corresponded with their type of synesthesia (Ward, Thompson-Lake, Ely, & Kaminski, 2008). For example, individuals with synesthesia related to music were more likely to play a musical instrument (Ward, Thompson-Lake, Ely, & Kaminski, 2008). Yet, there was no significant relationship found between synesthesia and controls on the creativity test given (Ward, Thompson-Lake, Ely, & Kaminski, 2008).

The ability to connect seemingly unrelated ideas is the basis for metaphor, a linguistic and literary device used to understand language or ideas. Creative individuals more readily use this device, and synesthetic experiences are similar to metaphor, as they are another way of linking seemingly unrelated stimuli. Therefore, this may help explain why synesthesia may be found more commonly in creative individuals (Cytowic & Eagleman, p. 164, 165).

Domingo et. al (2010) found that in a particular division of grapheme-color synesthetes, called projectors, creativity was significantly higher than controls, but was not significantly higher in grapheme-color associator synesthetes. Other studies demonstrate a stronger synesthetic association in more creative individuals than in less creative individuals (Dailey, Martindale, & Borkum, 1997). This means that the stronger association between sensory modalities was found in more creative individuals. Another study performed on synesthetic fine

arts students suggested a significantly higher score than the control group on four different creativity tests (Domino, 1989). In this study, Domino (1989) argues that these results are consistent with self-report findings on the level of creativity in synesthetes.

Essentially, since results seemed mixed for the link between creativity and synesthesia, future research needs to be performed, comparing different forms of synesthesia using common, objective creativity tests.

The Present Study

The current study attempts to add qualitative data to what is known about synesthetic creativity in art through artistic representation of my own synesthetic experiences accompanied by an explanation of how each piece conveys that particular percept. My synesthesia is characterized as constitutional, as I have experienced this phenomenon since I can remember, although it wasn't until I was 16 years old that I realized my synesthesia was something atypical. The main forms of synesthesia I experience are grapheme-color and ordinal-linguistic personification. This means that letters and numbers have an associated color, as well as a gender and personality. Therefore, my artwork for this project will attempt to convey not only the color but also the personality of the numbers one through ten.

Materials and Methods

Although I do experience color associations with letters as well as numbers, I chose the numbers one through ten as my subject, as they exhibit a range of colors and personalities that exemplify my synesthesia. I chose to stop at the number ten because after the number ten, my colored percepts begin to repeat. For example, I experience the number one as white, but I experience the 1 in the number ten as black, while both the 1's in the number eleven are white.

For the preliminary paintings, I will be working with acrylic paint on stretched canvas. The final product will be on 24" by 24" hardboard, first layered with gesso to create texture, then painted with acrylic paint, finished with a clear, glossy varnish. Each piece will represent the number's color as well as their personality through color choice, texture, and shape. Color choice is key in these pieces, as capturing the specific color I see for each number is important in producing work most similar to what I experience.

Results



Figure 5. Number One, acrylic on hardboard

The number one (Fig. 5) is a female, associated with the color white. Her main characteristic is her motherly nature. As one and two have a close relationship, and two is the number that one mothers the most, I included blue, two's associated color, in a corner of this piece to show the influence of their relationship. I incorporated textures and gradients that created a calming water feeling to the piece to show the calming motherly disposition of one. With gesso, I created a seashell, wavy pattern in the blue corner and created smooth, sweeping motions like the shore of a beach for the white portion. With acrylic, I gave the blue corner a feeling of light hitting a pool of water.

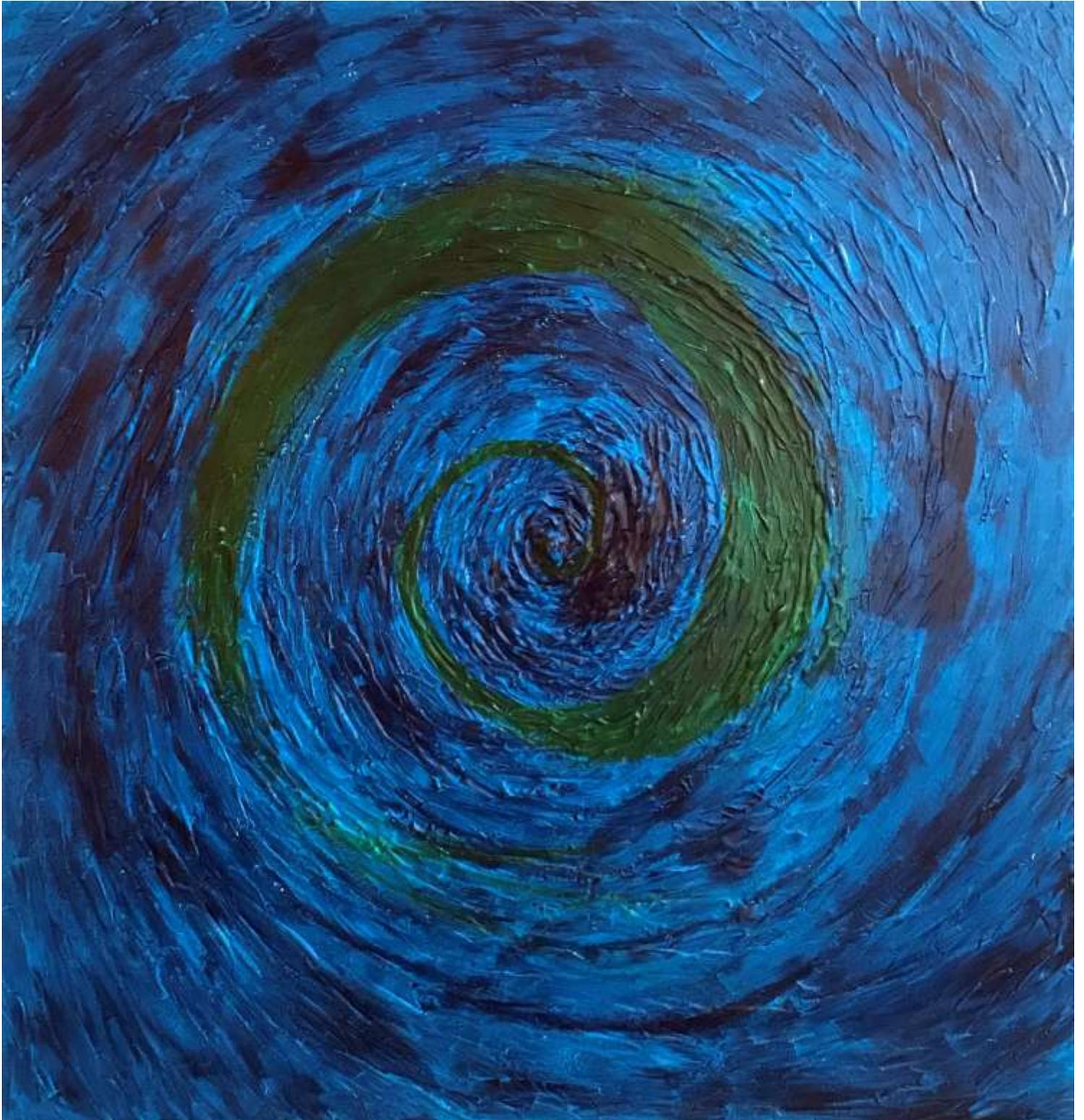


Figure 6. Number Two, acrylic on hardboard

The number two (Fig. 6) is a male, associated with a royal blue color. His main characteristic is his childish mischievousness, hence why one feels the need to mother him constantly. I aimed to exemplify two's personality by texturizing the piece to look like a spiral. The spiral is primarily royal blue, with a section of green, the color I associate with three, following the spiraling motion to exemplify the friendship between two and three. I did not include white in this piece because two does not perceive an influence of one on his life in the same way that one perceives the presence of two in her life. Two is more concerned with his friendships and causing trouble than his familial relationships.



Figure 7. Number Three, acrylic on hardboard

The number three (Fig. 7) is a male, and is associated with an emerald green color. His main characteristic is his level-headedness. Although three is around the same age as two, and they are close friends, three is more mature and more likely to think before acting. When he is not getting wrapped up in two's trouble-making, three spends time with four to relax and talk to someone more logical like himself. Because three has this bond with two other numbers, I included subtle streaks of both blue and magenta. To exemplify a more level, logical personality, I added only a thin layer of gesso as not to add too much texture to this piece.



Figure 8. Number Four, acrylic on hardboard

The number four (Fig. 8) is a female, and is associated with a deep magenta color. Her defining characteristic is her rational mind. Although she is recognized superficially by her bubbly personality, those who know her better know she is methodical and enjoys exploring questions that aren't easily answered. In this way, she gets along well with three, as they can have thoughtful conversations, but her bubbly positivity eventually causes three to return to two's companionship. I used the gesso to create a texture that subtly traced the number four, a nod to four's rational, factual nature. Four does not feel a motherly pull towards three, nor does she heavily rely on his friendship, so green does not appear in this piece.



Figure 9. Number Five, acrylic on hardboard

The number five (Fig. 9) is a male, and is associated with a crimson red. Five's defining feature is his seriousness. While five is an acquaintance to four, six, and sometimes seven, he is often alone and wouldn't consider any of them his friends. Five has a no-nonsense attitude, which makes him abrasive and hard to get along with sometimes. However, deep inside he does care about others, he just shows it by being hard on them. I again used the gesso to hide the shape of the number within the piece. I created a mostly smooth, thin layer of gesso, with small circles with heavier texture to show five's ability to show emotion occasionally, and a larger circle near the bottom right to imitate the half-circle in the shape of the number five. I focused on the crimson red color I see five as, without including any other colors.



Figure 10. Number Six, acrylic on hardboard

The number six (Fig. 10) is a male, and is associated with a burnt orange color. Shyness is six's defining characteristic. His kindness doesn't always show to his friends seven and eight, as his desire to be kind and altruistic is overshadowed by seven's more dominating personality. There are many things that six would rather do than hang out with seven and eight, but he feels he has a responsibility to them, so he's stuck in his situation. Again, I used gesso to evoke the shape of the number six within the painting, with a large, thick circle in the bottom right with circular motions radiating from it. Even though six is part of a group, and would call his group members his close friends, he wishes to be independent from them, so I only used the burnt orange color I associate with six.

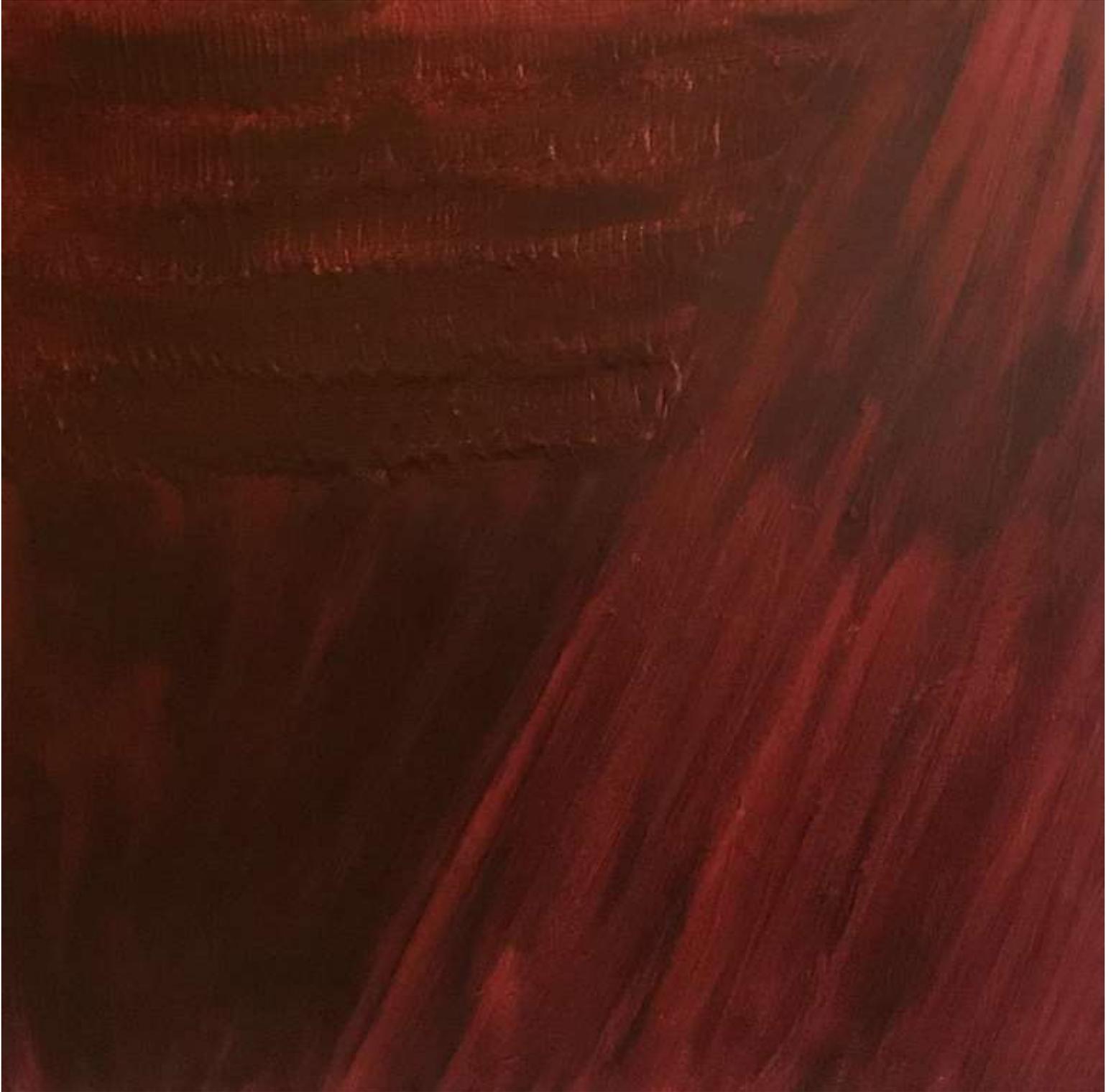


Figure 11. Number Seven, acrylic on hardboard

The number seven (Fig. 11) is a male, associated with a dark copper color. His defining characteristic is his intimidating nature. He's the leader of a group consisting of six, seven, and eight, sometimes involving nine and ten. He uses intimidation to get six and eight to do what he wants, which is typically something wrong. Once again, I used the gesso to create a subtle number seven within the piece. A section in the top left uses a shaky pattern to imitate seven's malevolent laugh, giving an unnerving quality to the piece. I used a reddish brown, copper color alone to show the color I associate with seven and the fact that he is independent although he leads a group with six and eight.



Figure 12. Number Eight, acrylic on hardboard

The number eight (Fig. 12) is a male, and is associated with a brown black color. Conformity is eight's defining characteristic, as he tends to follow anything seven says without hesitation. Because of this, he doesn't have much of a personality outside of the group. Eight's identity has been wrapped up in others, so I relied heavily on shape for this piece. With gesso, I created a figure eight pattern throughout the piece, then created two thick circles in the middle, vertically positioned, to evoke the circles created by a figure eight. The brown black shade not only shows the brown black shade that I associate with eight, but also shows how ingrained seven's personality is within eight.



Figure 13. Number Nine, acrylic on hardboard

The number nine (Fig. 13) is a male, and is associated with a purple gray color. Like six, nine struggles to meet his desires, as his defining characteristic is his cunning. Nine works closely with ten, and sometimes meets his demands, but often only does it if it's beneficial to him. If not, he refuses and does what he wants. Nine is unpredictable and, like two, is a trouble-maker but doesn't harm others. He tends to try to bend the rules to fit his needs, and attempts to persuade others to his goals. He is different from seven, however, as he has no ill will towards anyone and merely means to trick and get what he wants, not cause harm. Gesso was used to create a smooth texture, with thick dots in the upper region to exemplify the relationship between nine and ten. A larger, thicker circle shows the circle created by the number nine.



Figure 14. Number Ten, acrylic on hardboard

The number ten (Fig. 14) is a male, and is associated with a charcoal color. Ten is primarily characterized by his leadership abilities. He mainly associates himself with nine, but due to his unpredictability, ten often has to get things done himself. He tries to keep seven and his group members in line when they start to get out of control. Ten is an introvert so being a leader is a draining experience, so he enjoys his solitary time. Generally, he has a happy, positive spirit. I first created a layer of dots scattered through the piece with the gesso, then put a thin, smooth layer of gesso on top of the first layer. Along with an overall charcoal color, I included brown black dots to emphasize some of the gesso dots, mostly scattered along the outer edges of the piece.

Conclusions

Essentially, synesthesia is a phenomenon unique to everyone who experiences it, despite certain cognitive and personality traits that are common among synesthetes. While researchers have expanded knowledge on synesthesia considerably since the emergence of neuroimaging techniques, there are still gaps to be filled in the knowledge base. For example, the degree to which genetics play a role in the emergence of synesthesia and the debate on whether synesthesia influences creativity. While synesthesia appears to cause creativity on a superficial level, evidence suggests that this is merely a surface-level, anecdotal linkage between them.

Within the realm of my own synesthesia, I believe it influences my level of creativity by acting as a pool of inspiration to draw from in my artwork. While I don't consider my creativity as higher than average, I do enjoy creative pursuits. Translating my synesthetic experiences into abstract art pieces was challenging in the fact that I wanted the colors within the pieces to reflect the colors I associated with the numbers as closely as possible. Seeing my synesthesia come to life has been a rewarding experience and has hopefully contributed to the synesthetic art world.

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