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Chromesthesia as Phenomenon: Emotional Colors

by

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## Chromesthesia as Phenomenon: Emotional Colors

Imagine listening to a piece of music and seeing colors with every pitch, change in timbre, or different chord progressions. Individuals with chromesthesia, also known as synesthetes, commonly experience these “colorful senses.” Chromesthesia is defined as “the eliciting of visual images (colors) by aural stimuli; most common form of synesthesia.”<sup>1</sup> Synesthesia is considered the wider plane of these “enhanced senses.” It is the condition where one sense is perceived at the same time as another sense.<sup>2</sup> This is why chromesthesia is narrowed down to be a type of synesthesia: because it is the condition where hearing is simultaneously perceived with sights/feelings (colors). This phenomenon incites emotions from colors in addition to emotions that music produces. Chromesthesia evokes strong emotional connections to music because the listener associates different pitches and tones to certain colors, which in turn, produces specific feelings. This essay will provide a breakdown of what chromesthesia is, how it is experienced, and how it works throughout the brain. This essay will then discuss what effect colors have on the brain through emotion, and how music elicits emotion. Tying the ideas of color, music, and emotion together, one can further understand how synesthetes (people with synesthesia or chromesthesia) feel, and why they feel this way.

When listening to a piece of music, we oftentimes imagine stories or create scenarios in our heads by using the lyrics or melody provided within the song. When asked to describe a piece of music, we can use adjectives such as *sad*, *happy*, or *anxious*. These adjectives give us a

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<sup>1</sup> George L. Rogers, “Four Cases of Pitch-Specific Chromesthesia in Trained Musicians with Absolute Pitch,” in *Psychology of Music*, (Baton Rouge: Louisiana State University: School of Music, 1987), 198-207.

<sup>2</sup> Melissa Lee Phillips, “Synesthesia,” Neuroscience for Kids, accessed: November 22, 2014, <https://faculty.washington.edu/chudler/syne.html>.

vision of how the piece sounds and which emotions it triggers. Synesthetes take these given emotions and also add the feeling of color. These “colored senses” are the basis of chromesthesia and are felt by synesthetes everywhere. Evidence suggests that between 5-15% of the adult population has chromesthesia, and 68% of this population has developed the condition from an early age.<sup>3</sup> This way we see that chromesthesia is something that certain people grow up with instead of being suddenly discovered.<sup>4</sup> Chromesthesia is seen through natural growth because colors and one’s interpretation about them develop over time. For example, some children were raised with playing on a colorful xylophone. Children with chromesthesia memorized the colors that represented the pitches played on the xylophone, so whenever they would hear a certain pitch, they would automatically see the color from the xylophone.<sup>5</sup>

“A cross-modal association” encountered by synesthetes activates the left side of the brain, which enhances the limbic expression: the system of nerves in the brain that controls moods and triggers emotions.<sup>6</sup> It decreases the blood supply to the neo-cortex, which is the part of the brain that is split up in four parts in charge of “processing information and controlling behavior”<sup>7</sup>, and activates both the visual and auditory sensors of the brain.<sup>8</sup> Because of this, scientists believe that associating color with sound is a chain of mental reactions. For example, if

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<sup>3</sup> Errol Anderson, “Chromesthesia: Feeling Music in Colours,” *Noisey: You need to Hear this*, last modified December 16, 2013. [http://noisey.vice.com/en\\_uk/read/youneedtohearthis-chromesthesia-feeling-music-in-colours](http://noisey.vice.com/en_uk/read/youneedtohearthis-chromesthesia-feeling-music-in-colours)

<sup>4</sup> Richard E. Cytowic and David M. Eagleman, *Wednesday is Indigo Blue: Discovering the Brain of Synesthesia* (Massachusetts: MIT Press, 2009), 241-51.

<sup>5</sup> Kathleen Marie Higgins, *Music Between Us: Is Music a Universal Language?* (Chicago: University of Chicago Press, 2012), 107-108.

<sup>6</sup> Dr. C. George Boeree, “The Emotional Nervous System,” Webpage: General Psychology. Accessed: November 22, 2014, <http://webpage.ship.edu/cgboer/limbicsystem>.

<sup>7</sup> Ibid.

<sup>8</sup> Cretien van Campen, *The Hidden Sense: Synesthesia in Art and Science*. (Massachusetts: MIT Press, 2008), 117-120.

you grew up listening to jazz in an orange room, every time you hear jazz, you might associate it with the color orange. Similarly, if you owned a blue keyboard as a child, you might think of the color blue when you distinguish a sound made by a keyboard. Each memory is tied with the chain of mental reactions that process sound, emotion, and the control of behavior. This justifies that chromesthesia is influenced culturally, and can be defined with colors by the way that one is influenced through everyday affiliated things.<sup>9</sup>

Most synesthetes have reported that they don't encounter color visually when listening to music; rather, they feel and experience the color that comes with hearing a certain pitch or tone. Instead of seeing colors, synesthetes "feel" them in the same way we feel emotion instead of seeing it. "I am seeing, but not with my eyes, if that makes sense."<sup>10</sup> Colors have always been emotionally triggering factors in every seeing person's day. For synesthetes, colors are not only red, blue, or yellow, but each color comes with a feeling or certain mood. When people hear the words, "I'm so blue" in a song, *blue* can be a description of one's feelings that triggers a sad emotion to be felt by the audience. By familiarizing ourselves with the word *blue* as a sad emotion, we can start experiencing blue tones for more somber pieces. Special case experiments have been done where certain subjects were given scales or certain pitches to listen to and then were asked to identify their perceptions of the colors that they saw and the emotions that were activated. The colors that were perceived as sad or negative were experienced usually when a slower, more somber piece was played.<sup>11</sup>

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<sup>9</sup> R. D'Andrade and M. Egan, "The Colors of Emotion," *American Ethnologist* 1, no. 1 (1974): 49-50. Accessed November 9, 2014, <http://www.jstor.org/stable/pdfplus/643802.pdf?&acceptTC=true&jpdConfirm=true>

<sup>10</sup>Cytowic and Eagleman, *Wednesday is Indigo Blue*, 88-89.

<sup>11</sup> William O. Krohn, "Pseudo- Chromesthesia, or the Association of Colors with Words, Letters and Sounds," *American Journal of Psychology* 5, No. 1 (1892): 31. Accessed October 25, 2014, <http://www.jstor.org/stable/1410812>.

In one experiment, subjects with self-proclaimed relative or perfect pitch were asked to identify their personal visualization of a color when a pitch was played, and report if the color came with an emotion.<sup>12</sup> Perfect pitch is a common characterization of someone who has chromesthesia.<sup>13</sup> A dominant color for the pitch G was either red or green. Each subject described G as a happy and bright pitch, making the emotion of pitch G unanimously a happy one. The same phenomenon of experiencing color with music can be seen in the timbre or dynamic levels of songs. For example, Subject 3 stated that if they heard a piece that was transposed from the original key, it sounded “wrong” to them because it did not match the mood with the pitch level of the music.<sup>14</sup> This shows how our mind takes in every detail of music, down to the choice of timbre or key in the piece and creates a whole illusion of color as part of the listening sense.

A key component to having chromesthesia is color-consistency. When any human associates colors to different pitches, timbres, and dynamic levels, the colors that are provoked stay the same for the rest of one’s life.<sup>15</sup> For example, if whenever a synesthete hears Elvis Presley’s voice, they experience a greyish blue tone, that color tone will always show up for them when they hear Elvis Presley unless influenced by other color-enticing factors. If the person’s color association for Elvis Presley’s voice changes, they are most likely not a true synesthete. Many experiments to distinguish a true synesthete have led to failure, except for what is called the *Consistency Test*, which was first created by English neuropsychologist Simon

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<sup>12</sup> Rogers, “Four Cases of Pitch-Specific Chromesthesia,” 199-100.

<sup>13</sup> Ibid.

<sup>14</sup> Ibid., 103

<sup>15</sup> Oliver Sacks, *Musicophilia: Tales of Music and the Brain* (New York: Alfred A. Knopf, 2007), 165.

Baron-Cohen in the 1980s. Though exhaustive, this was the only way to distinguish a true synesthete from someone with a sensitive memory with colors.<sup>16</sup>

We train our brains to remember our feelings about certain memories of color. From a young age, we were brought up thinking of the sun as a bright happy ball of light, which brings joy to our lives. In a study done about college students' preference of colors, a handful of students were individually shown colors and were asked to describe their emotions toward it.<sup>17</sup> Of the students, 91.5% agreed that green and yellow were the most positive colors since they associated with the sun, Easter, spring, and other repetitive visuals of these colors. On the contrary, the color greenish-yellow was agreed to be 71.4% geared toward negative emotion because of its association with vomit and feeling of sickness. This highlights the idea that once we associate a color with an idea of an emotion, or in this case mental state, that feeling will stay with the color for the rest of your life.<sup>18</sup>

Having a clear idea on how colors work inside our brain, the role music plays in our lives neurologically is important to understand to have a clear idea of what a synesthete experiences every day. Recent technological advances have allowed neuroscientists to make advances about learning how the human brain takes in sound waves and makes music in our brains. While listening to music, neurotransmitters are released inside the brain, which in turn elicits certain emotions. The release of dopamine can enhance a happier emotion while listening to music; this usually happens while listening to upbeat music or any music that creates a happy emotion. Also, increase flow of blood and oxygen to parts of the brain can determine the emotions felt while

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<sup>16</sup> van Campen, *The Hidden Sense*, 124-125.

<sup>17</sup> Naz Kaya and Helen H. Epps, *Relationship between Color and Emotion: A Study of College Students*. Georgia: H.W. Wilson Company, 2004. PDF article.

<sup>18</sup> Ibid.

listening to a musical piece.<sup>19</sup> Even though we have studies on how music has effects on our brain, there are no successful studies done to find the reason behind synesthesia in the brain and if your brain functions differently if you have this power.<sup>20</sup>

Emotions from different musical pieces not only come from the sound that your temporal and frontal lobes process, but the factor of lyrics in the piece demand the Broca's and Wernicke's areas to help process the language of the music.<sup>21</sup> Since lyrics give us a clear sense of the context of the song (lyrics about a person dying trigger sadness whereas lyrics about getting married usually trigger happiness), our brain permits us to feel justified emotions since it processes specific lyrical meanings. Music also directly reflects memory. Each piece of memory triggered by music develops from certain emotions, which provide the basis of a synesthetic experience. These developed emotions are called "pseudo-emotions."<sup>22</sup> When we make ourselves more emotionally available while listening to music, we can start feeling certain emotions that we otherwise wouldn't. This usually happens when we go into deep analysis of the music or breakdown of the lyrics, helping us understand what emotions the song lyrics are trying to trigger within the listener.

According to overall research based on several sources, although there are no physical changes in the brains of synesthetes or non-synesthetes, the way that the brain processes emotions is clearly stronger with people who have chromesthesia.<sup>23</sup> Since synesthesia is Greek

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<sup>19</sup> Nick Zangwill, "Music, Metaphor and Emotion," *The Journal of Aesthetics and Art Criticism* 65, no. 4 (2007): 392-393. Accessed November 4, 2014, <http://onlinelibrary.wiley.com/doi/10.1111/j.1540-594X.2007.00272.x/full>

<sup>20</sup> Krohn, "Psuedo- Chromesthesia," 20.

<sup>21</sup> William J. Cromie, "How Your Brain Listens to Music," *The Harvard University Gazette*, last modified November 13, 1997, <http://news.harvard.edu/gazette/1997/11.13/HowYourBrainLis.html>.

<sup>22</sup> Krohn, "Psuedo-Chromesthesia," 20.

<sup>23</sup> Krohn, "Psuedo-Chromesthesia," 34.



for “together sensation,” it is clear to see why people who have this phenomenon experience stronger sensation in their senses. Not only is one’s auditory cortex lit up while listening to music, one’s visual cortex is in full gear because of the images and sparks of color that people with chromesthesia experience. Although the visual cortex can light up for people who don’t have chromesthesia (when reading music or watching a musical performance), the colors felt through chromesthesia trigger the visual cortex, nucleus accumbens, and the amygdala: both places in the brain where there are emotional reactions to music.<sup>24</sup>

When combining the brain’s process of producing certain emotions to color and music, we create the basis of an everyday synesthetic experience. Music and color tie in very closely together because of how each of them can influence one another. In *The Hidden Sense*, Cretien van Campen discusses how the Dutch painter Vincent van Gogh took piano lessons to get better acquainted with tones that colors create. Piano helped Van Gogh’s musicology, letting him understand the way that music’s attraction to color enhances one’s emotions. Van Gogh would attend many musical concerts to find inspiration between different instruments and the way that they color the piece of music. He was inspired to do the same in his visual pieces. The activation of musical emotion helped him compare his emotions triggered by colors in music and visual art.<sup>25</sup>

Similarly to different colors resulting in emotions, different genres of music have an effect on what kinds of feelings are elicited. For example, a newer genre of music, dubstep, consists of electronic noises with ambient beats and rapid sounds that lead to “beat drops.”

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<sup>24</sup> Belle Beth Cooper, “The Surprising Science Behind What Music Does to our Brains,” *Fast Company*, last modified December 6, 2013, <http://www.fastcompany.com/3022942/work-smart/the-surprising-science-behind-what-music-does-to-our-brains>

<sup>25</sup> van Campen, *The Hidden Sense*, 119.

I find the distorted bass oddly soothing... achieving a wonderful state of flow through the bass drops... One can hear and feel tonal patterns, inviting melodies, crescendos and satisfying drops.<sup>26</sup>

Dubstep is one of the many musical forms that stimulate strong colorful reactions from synesthetes. Because of their ambient sounds and sudden bass drops, the color experience is extreme for synesthetes. Taking a different genre like jazz, synesthetes would experience something completely different because of the special tone that jazz creates with its ambient, soothing, and “cool” sound.

Musicians with chromesthesia usually have advantages over memorizing, making, and recognizing music.<sup>27</sup> Most synesthetes have perfect or relative pitch because they recognize a certain color with that pitch.<sup>28</sup> Stevie Wonder is a perfect example of a musician who makes the most of his gift of chromesthesia, for his unfortunate case of blindness. Because he cannot visually see notes on the piano and cannot read music, his extra senses of being able to describe certain notes as colors has enhanced his talent and career by 100%. Instead of reading notes off the page, he can connect color patterns together to create a melody on the piano.<sup>29</sup>

So the question stands: Do people with chromesthesia have a stronger emotional connection when they listen to music because of their moods already being triggered by colors? The answer is yes; based on my research people with chromesthesia not only get the advantage

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<sup>26</sup> Elizabeth Johnson, “Gifted Synesthesia Experiences Through Dubstep,” *Right Side of the Curb*. Accessed October 18, 2014, <http://www.rightsideofthecurve.com/articles/articles/creativity/gifted-synesthesia-experiences-through-dubstep>.

<sup>27</sup> Rogers, “Four Cases of Pitch-Specific Chromesthesia,” 198.

<sup>28</sup> Ibid.

<sup>29</sup> Phillip Brian Harper, “Synesthesia, ‘Crossover,’ and Blacks in Popular Music,” *Negro Artist*. Accessed on November 13, 2014, <http://www.negroartist.com/music/Crossover.pdf>.

of being emotionally challenged with lyrics and beautiful melodies of a song, they also have a factor of colors and tones that trigger emotions in their brain. In turn, when a synesthete listens to a piece of music, even if the song would be described as a thought-provoking ballad, the colors elicited from the piece can be represented as, for example, a dark green, where in some personal cases can represent a positive and energetic mood (depending on the subject.) In turn, the synesthete could see the piece as a positive, energetic song based on its color, even though the actual timbre of the piece is sad and slow.

Most of the time, composers of pieces purposefully try to paint a visual for their music so that the mood that they're trying to convey with the piece matches the mood attained from the colors being seen by people listening to their pieces. For example, writing the lyrics *soft* and *gentle* while the music becomes quieter. These colors can come from the changes in keys, use of instruments, and change in dynamics. A good example would be when a composer changes a mood of the piece from a slow and steady violin movement to a sudden barbaric and driven percussion movement. It's safe to say that the shift in dynamic level is enough to change the audience's mood of the piece, but the change in instruments can now change the color taken from the listener, which in turn can shift their mood once more.

Chromesthesia being the sound-to-color connection where sounds involuntarily create a relationship with colors and, therefore, trigger emotions is a common form of synesthesia. Synesthesia in general affects only about 15% of the population, and is usually a trait that one is born with and develops more and more over time. Although there is no successfully done research to find the neurological basis of synesthesia, it's clear that synesthetes have an advantage in many ways especially in memory, music, and combining their use of senses. Chromesthesia changes the way that synesthetes can experience music because of the emotions

elicited from the colors they see and the feelings triggered from the lyrics and instrumentation of the pieces. Our brains are very careful when processing music, and because of chromesthesia, synesthetes' brains have to process more than one emotion and feeling for the piece. Colors play a very important role in our everyday lives of picking out emotions. For example, if a pop song is played for a synesthete and they see the color pink, if they associate pink as a mellow and dreary color, their relationship with the music can change emotionally, even if the song has a positive and peppy message. These are the kinds of powers that synesthetes share and go through every day. Their lives are forever enhanced with colors, and their emotions are constantly tested with the blend of culture and their perception of color.

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