

Wu-Tang Clan and the Haunted Bike

Memorable affiliations between a moment and a song are among my most cherished experiences. Throughout my adolescence, music has broken down barriers that painful and beautiful memories hold; I often feel more emotion when listening to a song than I might with a human interaction. When I listen to a song that I correlate with a particular memory, a vivid remembrance of this time in my life occurs. Music is a unique cue that draws all senses of memory to the surface.

I began my research journey by exploring how memory is connected with music. I sought to understand how memory storage in the brain works. I found numerous studies that support the idea that we use the same areas of our brain for perceiving as we do for remembering. Brain scans taken while listening to and while remembering music depict no distinguishable difference between the two. Unique cues are best at bringing up memories which, in turn, provides evidence as to why specific songs elicit memories. The more items or contexts that a song is associated with, the less effective it will be at bringing up a particular memory. Although a song might be related to a certain time in one's life, it wouldn't be as effective at bringing up a certain memory.

Animation is similar to the process of creating music; so much effort and thought is put into creating a single second, a concept that people often overlook. This animation features memories that I distinctly associate with music. These specific memories are weighted with emotion. If music hadn't allowed me to feel safe when reflecting upon these moments, I would have otherwise been afraid to share.

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The Wu-Tang Clan and The Haunted Bike

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*I sat on the roof and kicked off the moss
Well, a few of the verses, well, they've got me quite cross
But the sun's been quite kind while I wrote this song
It's for people like you that keep it turned on*

~ "Your Song" by Elton John

Around 8th grade, I endured what I consider to be my first heartbreak. It was with my best friend, and to this day the hardest breakup I've gone through. My friend explained she didn't want to be friends with me, and she began to hang out with the semi-permanent popular girls who exist in almost everyone's middle school experience. After my friend ended our relationship, I would take walks at night, bundled up against the cold Vermont winters never without my headphones in my hand. I tried to figure out if I was more upset with myself for not being good enough to maintain the friendship, or with my friend for leaving me. I turned to my music in an attempt to make sense of the whole ordeal. The songs I remember during this period in my life allowed me to safely feel vulnerable when I was listening to them on my walks. I listened to these songs by myself, but I didn't feel alone. I surrendered myself to the music, allowing myself to trust these musicians and composers. I let their words and rhythms¹ take my mind outside of my body. What I have learned in my interactions and conversations with others is that many of us are reluctant to let ourselves become vulnerable to the powerful feelings music can evoke. Music can often break down barriers that painful memories hold, and allow us to feel more than we might with a human to human interaction. Songs can resonate with us and make us feel safe, enabling us to let down our guard and let the music take us over.

About a year after the falling out with this friend, my family and I were driving home from Thanksgiving at my grandparent's house. I felt lighthearted and grateful as my parents played music while we made our way back to Vermont. I soon recognized the light strumming guitar and scraggly voice coming from the car's sound system and was sent back to my cold night walks of the previous winter.

*Here come the tears
But like always, I let them go
Just let them go
Well I walk upon the river like it's easier than land
Evil's in my pocket and your strength is in my hand*

~ "Love is All" by Tallest Man on Earth

Love is All, by the Tallest Man on Earth, changed my mood completely and brought me back to feeling hopeless, desperate, and confused after listening to only 15 seconds of the song. I was self-aware enough to realize that I wasn't currently feeling these emotions, but fascinated by the fact that a single song could make me feel like I still was. When the song ended, I didn't have the same pure happiness from spending a lovely day with my family. This feeling had been tainted by emotions that I had felt over a year ago. After this experience I was left with the question: Why do specific songs bring up memories?

Memories are encoded in groups of neutrons² that, when set to correct values and configured in a particular way, will cause a memory to be reclaimed and replayed in the theater of our minds. In theory, if we had all the right "cues," we could access any past experience.

¹ Rhythm, meter, and tempo are related musical concepts that often get confused with one another. Rhythm refers to the length of notes, tempo refers to the pace of a piece of music (the rate at which you'd tap your foot to it). Tempo is measured in BPM, or beats per minute. One beat every second is 60 BPM. Tempo is like the "heartbeat" of the song (underlying beat). It is the pulse of music. Meter refers to when you would be tapping your foot, vs. how hard and how light these taps are grouped together to form larger units.

² Neutrons are the particles in an atom that have neutral charge.

Tune recognition requires many complex neural computations connecting with memories. Our brains have the capability of analyzing multiple different frequencies that reach our ears and put them together in just the right way. Our brains don't have the perception of disembodied harmonies, they construct separate mental images of each sound for us. Take for example the flute or the drums, our brain also has the capability to create the picture of these sounds playing together. In order to recognize a song, our brains must focus only on features that are invariant to a song. The brain must be able to separate aspects of a song that remain the same each time we hear it from one-time variables. If our brain wasn't capable of this process, each time we listened to the same song at a different volume we'd think it was a totally different song.

The theory that unique cues are best at bringing up memories provides clues as to why specific songs bring up memories.

The more items or contexts that a song is associated with, the less effective it will be at bringing up a particular memory. Although a song could be associated with a certain time in your life, it wouldn't be a useful cue for retrieving memories from those times if the song had been played continuously and you are used to hearing it in many situations. As soon as we hear a song from a particular time, the floodgates of memory open and we are immersed. Music is a unique memory cue as it unlocks a particular experience, place, and time.

There are two ongoing debates explaining how the brain's memory storage works; the *constructivist theory* and the *recordkeeping theory*. The constructivist theory claims our brain stores information between objects and ideas, but not details about the objects themselves. It is called the constructivist view because the theory supports the idea that learning is an active, contextualized process of constructing knowledge rather than acquiring it. Constructivists believe we compose a memory depiction out of these revelations and that memory improves when the retrieval environment³ stimulates the same portions of the cognitive system⁴ used to interpret the original memory. Constructivists believe that memory's function is to ignore insignificant details while preserving the summary. The *record keeping* theory supports the idea that our brains remember virtually everything, and interference (forgetting things) is mainly due to the distracting effects of other memories which increase in number as the amount of information to be remembered increases. Music plays a significant role in the debate between these two theories.

Using electroencephalogram (EEG)⁵, Petr Janata conducted a study that kept track of people's brain waves while they listened to music and while they remembered music. Janata wanted to compare the scans and view the differences in an attempt to understand how our brain remembers and perceives music. For the scan, people lay down in a MRI to measure changes in blood flow in the brain. It was nearly impossible to tell from the data whether people were listening to or remembering music. The pattern of brain activity was virtually indistinguishable.

³ Memory retrieval refers to the subsequent re-accessing of events or information from the past, which have been formerly encoded and stored in the brain.

⁴ Cognition is the mental process of acquiring knowledge and understanding through thoughts and experiences. It comprises processes such as attention, the formation of learning, memory and working memory, judgment and evaluation, reasoning and "computation," problem-solving and decision making, comprehension and production of language. Cognitive processes use existing knowledge and generate new knowledge. The frontal lobe of the brain is responsible for higher cognitive skills (problem-solving, organizing) and the parietal lobe is involved with sensory processes, attention, and language.

⁵ An electroencephalogram is a noninvasive test that records electrical patterns in your brain. An EEG tracks and records brain wave patterns.

Based on these results, an assumption can be made suggesting that people use the same brain regions for perceiving as they do remembering.

When thinking about or listening to a seldom played song that you associate with a certain memory, you will have a vivid remembrance of this time in your life as music is a unique cue that draws all senses of a memory to the surface. We know why certain pieces of music have an this effect on us, but why are we drawn to listen to these songs in the first place?

When a song is too simple, we tend to not enjoy it finding it to be trivial. When a song is too complicated, we tend not to like it because it is unpredictable. Just like any form of art, music must achieve the correct balance between simple and complex for it to strike a chord with the listener. Some people can't stand the sound of the loud, thumping beats of hip-hop, while others hate the shrill "whiny" sound of the violin. This may be a matter of physiology. Different ear anatomy might transmit different parts of the frequency spectrum⁶, causing certain sounds to be enjoyable for some and awful for others.

I was lucky to grow up in a household where music was playing throughout every road trip, every spring cleaning day, and every playdate I had. I may be biased to my parents' musical tastes, but I grew up with the good stuff. In second grade when I asked to sing the Grateful Dead's Shakedown Street at a Hannah Montana karaoke birthday party, I was the odd one out and I wouldn't have had it any other way. Starting at a very young age, I associated movement, both physically and mentally, with music. I watched as my mom danced around the kitchen sometimes spinning me in her arms. I laughed as my dad rocked out in the car to his favorite tunes, and I saw the waves of emotions my grandmother received as she sang along to her music from church. The rhythm in music was what my feet danced to, my hips swayed to, and lips mimicked.

As I grew older, my musical taste adapted to "my own." I realized that trying to appreciate new music was more difficult than listening to what my parents always played around the house. In many ways venturing into a new artist or genre of music is similar to creating a new relationship. You're timid at first, and there is no way to speed up the process. You spend time with that song, album, or playlist until you decide if you want to keep listening.

Musical preferences are largely socially acquired through knowledge of what our family and friends like to listen to and knowledge of what the music stands for. Music is involved with many social activities⁷. This could explain why the most common form of musical expression is the love song, and why for many of us love songs seem to be among our most cherished possessions, though they may not be tangible.

Around ten or eleven years old is when people normally take an independent interest in music⁸. As adults, the music we consider to be "our music" generally stems from the music discovered during our adolescent years. Teenage years are emotionally charged times, fostering experiences we remember for the rest of our lives. Our amygdala⁹ and neurotransmitters¹⁰ act

⁶ The audio spectrum is the audible frequency range humans can hear. The audio spectrum range spans from 20 Hz to 20,000 Hz and can be effectively broken down into seven different frequency bands, with each having a disparate impact on the whole sound.

⁷ For example dancing, concerts, parties.

⁸ Barnes, Tom. "There's a 'Magic Age' When You Find Your Musical Taste, According to Science." *Mic*, Mic Network Inc., 26 Oct. 2015, mic.com/articles/96266/there-s-a-magic-age-when-you-find-your-musical-taste-according-to-science#.hsTmhVagN.

⁹ An almond-shape set of neurons located deep in the brain's medial temporal lobe. The amygdala plays a vital role in the processing of emotions.

together to tag specific memories as “important”. While there is no cut-off point for forming new tastes in music, most people seem to define their tastes between eighteen and twenty.

Notably in Western culture, our musical choices have social consequences. When we are young and in search of our identity, we tend to form bonds with or respect groups of people we want to be like. While it can be argued person’s musical taste stems from their personality, for the most part, musical taste can be determined by where you grew up, who you hung out with, and the music they happened to be listening to.

I grew up listening to the Beatles, the Grateful Dead, Pink Floyd, and other similar artists my parents liked. Until I was around twelve, I wasn't open to hearing different types of music, I was attached to my perceived musical taste (which was really my parents’). During middle school, my social group began to venture into the genre of rap music, and I found myself starting to listen to rap independently. Suddenly I found myself enjoying artists like 2pac, The Notorious B.I.G., Mos Def, and Wu-Tang Clan. Since middle school, my music tastes have expanded and changed repeatedly due to the people I have surrounded myself with and music I have independently discovered. But I always find myself coming back to enjoy the music I loved so much when I was younger.

When I was six years old, I sang John Denver's "Take Me Home Country Roads" in front of my entire elementary school at the annual talent show. I was just shy of four feet tall had recently cut my bangs myself and believed I had the voice of an angel. Singing this song up on stage is the first memory I have of my drive to present to the world how music makes me feel. I’ve since come to terms with the fact that I, unfortunately, do not have the voice of an angel, but I didn’t get on that stage to impress others with the quality of my vocal talent. I wanted others to feel how I felt listening to John Denver as he sang the lines,

*Country roads, take me home
To the place I belong
~ “Country Roads” by John Denver*

I wanted my listeners to feel the surge of warmth I felt through my body as I thought about the dirt roads that ran through my hometown. I wanted them to understand that my beautiful house sitting amongst the Green Mountains of Vermont was where I belonged. I wanted them to know that this song made me feel like home.

¹⁰ A neurotransmitter is a substance (such as norepinephrine or acetylcholine) that spreads nerve impulses across a synapse.

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