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# Memory and Music

Sean Harty

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## Introduction

When starting this process, I knew that I wanted to do some type of research into memories, specifically how memories were associated with music. This idea came to me from a poster session I saw at the 2016 American Music Therapy Conference where a presenter was trying to map the brain patterns of elderly individuals based on how often they listened to music. While continuing to think of ways that I could consider this idea more, I thought about the emotional impact that music has on people, and started to think of ideas of how I could tie emotion into the research question. Through my experience as a performer and by doing service- such as going to nursing homes and singing with my fraternity- I was able to witness what are called evoked emotions, in which music is able to clearly evoke an emotion in the listener. As a performer, I can witness many different emotions present themselves in audiences, especially during concerts that were fully instrumental, classical music. These emotions included a wide spectrum from excitement to the feeling of stillness that comes after performing a slow adagio. I found a different reaction that presented itself when a group of friends and myself went to a local nursing home and sang popular music in the fall and spring, or Christmas carols in the winter. This reaction was more introspective, and more powerful. People who hadn't noticed that we entered the room, and sometimes didn't seem to notice that we were singing to them at all, would light up when they heard a song that they remembered from their past and would start to sing along with us. Around Christmas when we would sing *Silent Night*, the residents would often cry; some happy, embracing their family who were there with them, others in a way that seemed sad, possibly remembering something or someone that they missed.

A similar story happens in Islene Runningdeer's book, *Musical Encounters with Dying*.

Islene Runningdeer is a music therapist that worked primarily in hospice and later started to record the stories and lives of her patients. In the book, Runningdeer tells the story of her patient Mavis. Mavis was an elderly woman who had eight children, six of which died before Mavis herself did. Despite this Runningdeer notes that she has always endured and was friendly and pleasant. Mavis, in her last few months, found comfort in the song *You Are My Sunshine*, a song that brought her memories she shared with her children, and would request from Runningdeer that they sing it in every one of their sessions. Both when singing, and after Mavis would smile and sit retrospectively as she thought about the song and all the things she had associated with it (Runningdeer, 2013). From all the emotions that I observed, the two that I chose to focus on were nostalgia and trauma. After deciding the emotions, I planned to research how music affects the memory recall of memories associated with nostalgia and trauma, and if there is any difference between classical and popular music. The way that I am using these two emotions in my paper may not be the same way that they are frequently thought of in society or pop culture so I have provided my definitions in the next section.

### **Defining Emotion**

Two terms will be used in this paper that are different from their standard use, the first is nostalgia, the second is trauma. Nostalgia is an emotional state that recalls happiness or positive emotions of the past. Nostalgia is most commonly associated with memories, but can also affect a person's emotional being. Nostalgia can be contextualized in terms of this paper through the following example. A person driving in their car is idly switching through channels on the radio. As they change they hear the last part of their favorite song from when they were younger on one of the stations they scan past. This small part of the song brings happiness to the listener, and recalls memories of when they were younger, and the times they spent with the people and

places that they have associated with this song. The experience of hearing this song gave the listener both an emotional happiness as well as recall of pleasant memories, demonstrating nostalgia.

Trauma is another term that will be used throughout this paper. Trauma is defined as a negative emotion or experience from a person's past that when recalled has a negative bearing on a person's mental state, often coupled with a feeling of reliving the event. David Morris, an American novelist and former marine explains how trauma can appear from any ordinary object,

Trauma destroys the fabric of time. In normal time you move from one moment to the next, sunrise to sunset, birth to death. After trauma, you may move in circles, find yourself being sucked backwards into an eddy or bouncing like a rubber ball from now to then to back again. ... In the traumatic universe the basic laws of matter are suspended: ceiling fans can be helicopters, car exhaust can be mustard gas.

— David J. Morris, *The Evil Hours: A Biography of Post-Traumatic Stress Disorder*

People experiencing trauma can experience flashbacks such as events during their service, which leads to panic attacks brought on from their post-traumatic stress disorder. In this example, hearing a ceiling fan, or smelling car exhaust are not the traumatic items themselves, the pairing of a past event to a current object is what causes the trauma, regardless of the sensory information that caused it.

Some musics can bring back emotions that fall on the continuum of nostalgia and trauma. A common one is sadness, which is not as severe as trauma but still has a negative bearing on the listener. Due to the level at which they differ, I have chosen to separate the standard concept of

sadness from trauma. Negative emotional responses that are not traumatic will be considered evoked sadness for this paper. The reasoning for this is that while sad memories do place a negative bearing on a person's emotional state, it is not as severe of a bearing that trauma would cause. Also, trauma implies that the person experiencing the event feels as though they are momentarily reliving the event, as opposed to just being reminded of it.

|                |  |
|----------------|--|
| Nostalgia      | When positive emotions or memories of the past are recalled, often improving the mood of the one experiencing the recall.  |
| Evoked Sadness | When a person is made sad from a stimulus, however the sadness has no significant bearing on the person's state, and the experience fades relatively soon after. |
| Trauma         | When a stimulus causes a person to relive an experience from their past that causes lasting distress to the affected. The experience causes severe distress.     |

Nostalgia is a trait commonly associated with the elderly. Stories are often told from the perspective of an older person reflecting on their life. People will often sit with the elderly and ask them to tell them details about their lives. Something that is usually not thought of in our society is the trauma that the elderly experience. These traumas are the same ones that are carried with them throughout their lives, and are not forgotten simply because they are aging. In this paper I plan to look into how nostalgia and trauma correlate with the elderly, specifically third agers. Third Agers are the population of people entering retirement or people in late life or assisted care.

## **The Aging Brain**

Like many aspects of human life, the brain's strength is not consistent across all people or populations. And since it is an organic being, this power decays as we age. The decaying of our brains is partially what causes us to lose memories that have been stored in our long-term memory. Similarly, as we age it becomes increasingly difficult for the brain to commit memories from the short-term memory into the long-term memory, explaining why younger individuals remember small details more than older individuals (Davis et. al 2003). The memories that remain in the long-term memory after aging are memories that hold a stronger meaning for the person retaining them, and will create stronger responses.

There are many tracks that the brain follows as we age, the first being Age-Associated Memory Impairment (AAMI). This is the path the brain follows regularly as we age. (Chen et. al, 2001). If the person has standard lapses in memory or cannot recall certain things, it is likely AAMI. Causes of AAMI are a decrease in the functioning of the medial parietal lobe(MPL), as well as a shift in functioning in the hippocampus. This shift occurs because of the hippocampus needing to work extra to code stimuli for memory storage since the sensory identifiers in the MPL begin to shut down with age (Miller et. al, 2007). Another track of aging is Age Related Cognitive Decline (ARCD). This is another normal part of aging that leads to forgetfulness, decreased cognitive function, and decreased problem-solving abilities (Ferris and Kluger, 1996). The hippocampus also plays an important role in keeping the brain at a functional level in ARCD. Both AAMI and ARCD are standard tracks of deterioration that our brains follow as we age, and are not often looked at as disease tracks.

A more severe track is Mild Cognitive Impairment (MCI). Though not as severe as dementia, MCI is a higher form of cognitive impairment than what is considered to be standard. People experiencing MCI are likely to find difficulties in retaining memory, expressing themselves with language, and will experience decreased control over thoughts and actions demonstrate how looking at patients in third age or late-life care will require an alternate method than those who are younger or who have entered stages of dementia.

As the risk for dementia increases, so do the amount of memories that a person will forget. Masao Yokota conducted a study in which he tried to create a new test for dementia screening. This was done by comparing his team's test to a pre-existing test. When comparing the results of both tests, the rate of memory loss is positively correlated with dementia scores. (Yokota et. al, 2000). This finding means that for people who are even approaching dementia they already have increased memory loss, people who enter dementia levels continue to lose memories at a faster pace as their dementia worsens.

|                                   | Typical Age Range   | Characteristics  |
|-----------------------------------|---|--|
| AAMI<br><br>(Miller et. al, 2007) | The typical adult can be considered for AAMI if they are at least 50 years old. | <ul style="list-style-type: none"> <li>❖ A noticed Decline in Memory Impairment</li> <li>❖ Lower scoring on memory tests</li> <li>❖ The memory decline is not associated to any Health issues such as heart attack or Alzheimer's</li> </ul> |

|   |  |   |
|---|--|---|
| <p style="text-align: center;">ARCD<br/>(Salthouse, 2009)</p> | <p>Many Variables impact age range, most commonly associated with people in their 60's</p> | <ul style="list-style-type: none"> <li>❖ Decline of at least two memory functions (memory recall, verbal recall, attention)</li> </ul>  |
| <p style="text-align: center;">MCI<br/>(Geda, 2012)</p>       | <p>Median Age presented is 60 years old.</p>   | <ul style="list-style-type: none"> <li>❖ Person doesn't exhibit complete signs of normal aging, or Dementia</li> <li>❖ Person can live independently</li> <li>❖ Clear loss of memory observed by both person and people close to them</li> </ul>  |
| <p style="text-align: center;">Dementia Spectrum</p>          | <p>Symptoms presented for diagnosis by age 70</p>  | <ul style="list-style-type: none"> <li>❖ The Dementia Spectrum includes many advanced forms of mental deterioration, some of these are Dementia and Alzheimer's Disease (Davis et. al, 2008)</li> <li>❖ Alzheimer's Demonstrates the severity of this spectrum as it has a mortality rate of 100% and acts within 15 years</li> </ul> |

The brain stores memories through a process of encoding based on the stimuli associated with the memory. The commonly accepted process follows this track. The memory enters the short-term memory where it is processed. While being processes it is decided if the memory should move into the long-term memory or be forgotten. If a memory is decided to be sent to the long-term memory it is sent through the hippocampus, where it is coded, then stored where it awaits recall (Greene, 1992). This process demonstrates why it is important to have a well-functioning hippocampus, and further demonstrates basic issues with AAMI and ARCD.

Different memories have different ways of being coded. In this essay, I have chosen to focus on Autobiographical Memories. Autobiographical memories are done by a *cyclic retrieval*. Cyclic retrieval means that the memories are retrieved by small cues, they are next the described memory is brought to consciousness where it is then evaluated in the context that the cue was given. (Collins, Gathercole, Conway, Morris, 1993). Autobiographical memories can be split into two different categories, *personal memories* and *flashbulb memories*. Personal memories are defined as a recollection of a specific episode from a person's past in which recalling the memory makes the individual feel as though they are reliving the event as it happened (Brewer, 1986). Personal memories are primarily based on a person's own introspections and the information that others present about the same episode. By contrast, Flashbulb memories are memories that are formed when an intense emotional event happens. The episode is then preserved very clearly as though the person obtained a mental photograph of the situation. The different between the two being that Flashbulb memories are less likely to be forgotten than personal memories because of the emotional significance of the event.

Autobiographical memories have a problem in research that would benefit the aging population. When coding the memory, the brain tries to break it down into too many facets such as how it relates to the self, to the individual, or to generic memory, and a trigger word that might further stimulate the recall of the memory, such as *California*. In this sense California would be able to draw memories of time spent in the state, experiences the person has in relation to the state, or general information facts that they may have learned about the state (Brewer, 1986). This would be able to benefit the elderly population where if they had forgotten one memory associated, the other possible coding tracks might be able to trigger related memories, helping to recall what they had forgotten.

## Music and the Aging Brain

Another trigger that works to recall memories is music—both the physical act of playing music and listening to it. A study by Megan Metzler, Deborah Sacuier, and Gerlinde Metz found that people who participated in music during their childhood had both a better recall of their childhood, and general life (Metzler, Sacuier, Metz, 2013). Their study suggests that musical training in early life reduces the effects of age-associated decline in the neural motor and cognitive networks, keeping basic memory functions and body movements functioning longer than they would in a person with no musical training. Vuoskoski and Eerola conducted a study analyzing how music impacts emotional memory recall, and found that specific songs that were known to a person, regardless of how long the association was, could incite emotions into the listener through memory recall (Vuoskoski and Eerola, 2012).

Alexandra Parbery-Clark and her team conducted a different study that measured the amount of change between the brains of life long musicians and third age non-musicians. Their findings report that there is a significant difference between the functional capability of the brain between the two groups. After this, they found that there is also no real difference between brain function of young musicians and third aged musicians. (Parbery-Clark et. al, 2012). These finding suggest that musical training at a young age has a strong enough impact on the shaping of the brain that the results are present many years into the future. The research next posed the question of if learning music in late age would help neural timing. To test this, they did a study on rats to see if exposure to music helped the rats develop a heightened sense of neural timing, to which the study found it did (Parbery-Clark et. al, 2012). This data suggests that if third agers are exposed to music, they too would be able to have an increased neural timing.

Third agers are also studied through less scientific means. Jacquelyn Wright writes about Dr. Pamela Pike of the University of Arkansas Little Rock, a piano faculty member who runs a program called *The Third Age Piano Class*. In this class, participants over the age of fifty are given exposure to musical ensemble by playing in a group of piano students all their own age. Dr. Pike is able to study the participants while engaging them, and allowing them to stay active in a way that lets them learn something new and interact socially (Write, 2007). While this type of exposure may not be done to study anything, the previous research suggests that in addition to a hobby, the participants are also getting the ability to prolong their neural timing and increase their emotional recall.

### **Music as an Emotional Stimulus**

In western culture, people often associate music with emotions. An example of this for many people who are not musically trained is the common association that major keys are happy and minor keys are sad. While this is not true of all music, it gives an indication of how strong emotional stimulation is associated with music in the western culture. Several studies, referred to as mood-manipulation or mood-induction studies, use music to try and alter the emotions felt by the participant in the study. Vuoskoski and Eerola's previously mentioned study had a section in which they tested the theory that "sad" music can induce sadness in the listener. What they discovered is that music can induce sadness in two different ways. If the listener has a strong association with the music that they are listening to, autobiographical memories can come into consciousness as a result of the association, thus inducing sadness in the listener as a result of the memory. The second condition that they found is that regardless of if a person is familiar with the music they are hearing, if they have high levels of empathy then the listener will likely become sad as a result of the music (Vuoskoski and Eerola, 2012). Susann Eschrich, Thomas

Munte, and Eckart Altenmuller ran a similar study, with the primary difference being the observation of happy music. The research findings also demonstrated that music that was not previously known to the participants was able to induce emotions. However, with happy music a person's levels of empathy were not a factor of how well the person responds. They found that music that was happier tended to have quicker tempos, which was a partial reason for increasing mood. When compared to music that was still happy but slower, the researchers found that happiness levels still increased in listeners showing that the tempo and rhythm played a role in increasing mood, but general effect of a piece was by itself enough to influence emotions (Eschrich, Munte, Altenmuller, 2008).

### **Differences Between Musics**

Classical music and popular music differ both in their composition and their use in society. To some, Classical music has become thought of as old-fashioned and boring, yet it is still used in advertisement. Reasonings for this use might be because of how widely known some piece are, allowing them to grab the attention of the listener for the ad. Popular music—which in this study will encompass Rock, Jazz, Folk, and all other musics that do not fall within the classical realm is—by definition, “popular”. These are musics that active in current society, the repetition of popular music in the few weeks that it tends to stay around allows listeners to form several associations with the music, however because popular music rarely returning after new songs have replaced it, the association might not be reinforced. What then makes it so that we have strong memories with one piece of music and not another? One possibility put forth by Richard Middleton is that timbre is what influences the difference. There appears to be a difference in how we respond to acoustic instruments as opposed to synthesized ones (Middleton, 2007). He suggests that we are more stimulated by acoustic instruments as they are

associated with old time music and this triggers a nostalgic response in us. I am not sure the level that this is still prevalent because of the decrease in the number of acoustic instruments used in the music younger generations are starting to grow up with, but I see instrumentation taking effect in another way.

Popular music that uses more acoustic sounds tend to be slower ballads, which allows for the listener to hear more of what is being said and take time to process it. This would allow them to have both an experience based memory and a verbal based memory. Music that is highly synthesized tends to be harder to understand, resulting in only experience based memories. This could be a reason that there is a stronger stimulation from acoustic instruments. Classical and Popular music also differ from each other based on social roles. Many people view art music as sophisticated music, and therefore it is hard to understand and take part in. Conversely, popular musics are thought to be relatable. With this difference drawn so hard what happens to the music in the middle that blurs the lines between classical and popular? Pieces like *Rhapsody in Blue* by George Gershwin heavily rely on Jazz idioms for the pieces composition and performance style (Taruskan and Gibbs, 2013). Other pieces such as Schubert's *Ave Maria*, which is composed entirely in the Classical style, have made their way into popular culture because of widespread use.

Then there are pieces that walk a much finer line, such as Samuel Barber's *Knoxville: Summer of 1915*. Pieces like this one might be able to produces a stronger association as they pull many features from both sides of the spectrum. *Knoxville* is a piece in the Classical style, with the instrumentation being a standard symphonic orchestra, but the soprano soloist sings the text of James Agee, an American novelist, poet, and film critic. Agee's text reflects a popularized nostalgic recall for a past, below is the first stanza.

It has become that time of evening when people sit on their porches, rocking gently and talking gently and watching the street and the standing up into their sphere of possession of the tress, of birds' hung havens, hangars. People go by; things go by. A horse, drawing a buggy, breaking his hollow iron music on the asphalt: a loud auto: a quiet auto: people in pairs, not in a hurry, scuffling, switching their weight of aestival body, talking casually, the taste hovering over them of vanilla, strawberry, pasteboard, and starched milk, the image upon them of lovers and horsement, squared with clowns in hueless amber.

-James Agee, *Knoxville: Summer of 1915*

The references to people sitting on porches, or the acoustic imagery of the people and cars moving along the road, are images that could be found in any number of popular songs in the country or folk genres.

At the time of "*Knoxville's*" premiere, shortly following the end of the second world war, it seemed to many, to be a piece that fit well into the popular oeuvre. Benedict Taylor researched how this piece fit with the American identity and found that there were several themes that presented in the piece that created an Autobiographical memory of America, referencing simpler times painting a picture of what the South felt like to live in. The text painting the picture, and the orchestration creating a simple timeless feel shapes the text and creates an affect for the audience (Taylor, 2008). This combination of orchestral music and folk like lyrics result in a pairing of stimuli that create stronger associations than if either were presented separately.

## **Storage of Musical Memories**

Music, including the text of songs, are stored in separate areas of the brain than are the centers for speech production and language recall. As these two neurological centers are not the same, it means that musical recall is able to take place even when other aspects of recall are not (Melton and Martin, 1972). While researchers are not sure exactly where the music center is located in the brain, the distinction from the verbal center is important. When the brain experiences music multiple parts of the brain are activated. By connecting these centers, stronger memories are formed. The separation of the memory storage areas is a partial explanation for the instances that occur when a person who has become non-verbal has a musical stimulation and either sings or talks for a short period following.

## **Relation to Music Therapy**

Music Therapists are therapists who use music to help their population. They work in several populations including schools, hospitals, geriatric centers, and private practice. They can use music to help with rehabilitation, stress release, and quality of life improvement for their clients. Islene Runningdeer found in work with her clients that music therapists can use their understanding of nostalgia and trauma to navigate how they approach working memory tasks with their clients (Runningdeer, 2013). This is important because someone who tries to do the work of a music therapist without the proper training could end up doing more harm than good if they are not cognizant of how to properly help the client. In fact this level of training is part of the purpose being the board certification in music therapy,

The MT-BC [Music Therapist- Board Certified] is a legally defensible program, i.e., all of its documents and programs are

developed and reviewed with this concept and responsibility in mind. This defensibility assures the right to work for the certificant within his/her scope of practice as developed through the Practice Analysis and identified in the Board Certification Domains. It also insures consumer protection for the public. The credential provides a means for the public to identify qualified practitioners who have passed a national exam measuring the knowledge, skills, and abilities necessary to competently practice in the field of music therapy (<http://www.cbmt.org/frequently-asked-questions/>)

A music therapist can correctly use their training and understanding of how music effects memories to be able to best benefit the client, regardless of if the client is a child or somebody in their last months of life.

### **Further Questions**

The first section of this paper addressed research into how the brain creates memories and how emotions are associated with both music and memory. My hope is that music therapists and other interested parties would be able to use this research to develop a better understanding of how memories function in a therapeutic setting, and would be able to apply that knowledge to their own therapies, particularly when working with third agers. While there are several studies looking at brain processes, and some about music, few overlap—especially when studying the aging brain. As a result of researching and noticing the gap in research, I started to think of other questions. The next section of this paper will present three research ideas that I had while

conducting the research for this paper. These studies have not been conducted and act as a representation of the direction that I would like to take this research in the future.

#### Study 1: Why does music evoke more emotions than other stimuli?

This study would look at why music causes a stronger emotional response than other stimuli. While there are other stimuli such as photographs that are strongly correlated with episodic and autobiographical memories, there is not a clear indicator of why music evokes stronger responses.

Previous research indicates that part of the reason music is so strong is because it activates more parts of the brain than do other stimuli. The areas most affected by music are the auditory cortex, the cerebrum, and the cerebellum (Bolles, 1988). The auditory cortex and the cerebellum make sense as they are associated with sound and movement respectively. The cerebrum holds the hippocampus which is a large memory center of the brain, this explains why music affects the region.

Music could possibly be such a strong stimulus as it has intense cultural associations. The previously mentioned major versus minor chord idea is something that represents emotion in a western society, but even with that idea there are still several examples of western music that break the mold of major:happy, minor:sad. If one were to travel outside of the Western culture this association would change, as other cultures do not build their music on the same tonality structure. Some cultures use rhythm, others a smaller selection of tones than are used in western music. This means that the possibility for music to be correlated with emotion is greater than the examples touched on in this study.

A difficulty that would need to be addressed in this study is that different people have different stimuli that activates their strongest response. Because of this the study would need to address what types of people, or cultural backgrounds, have music as their strongest stimulation. The study would also need to consider the already seen difference in response between positive and negative emotions evoked by music, and see if that plays a role in stimulation.

I was not able to run this study at my current level as it came up late in the process and would not have fit my timeline. There are several stimuli that could be tested against music that I would need to choose from, pictures and photographs seeming the most likely (Belfi, Karlnel, Tranel, 2016).

Study 2: Why does certain music evoke stronger memories than others?

This study stems from my original research question in which I attempted to find which facets of music are the most important in memory recall. Since I could only find studies that mentioned the idea, or gave singular elements of what could help shape the processing I did not feel like this part of my question was fulfilled. Therefore, I tried to think of how a study would be possible that allowed for observation of specific facets, and focused on recall.

Research has found that there are several areas in the brain correlated with different musical facets, but none have been found to be the sole center of a singular facet. Since the brain has several areas activated by music, one step in this study would be trying find these definitive centers in the brain. This would allow for researchers to isolate specific facets of different musical styles and see if they have any impact on the recall of a memory.

This study would also need to account for re-enforcement. As music is something that people experience multiple times in their life, researchers would need to find a way to account for the difference between pieces that are heard frequently from pieces that are rarely listened to. This might be a response scale for strength of the association and speed of recall or it could be that the researchers compose a new piece based on the regions and facets research, which they would then try to create an association with for the participants.

A difficulty in running a study of this nature is that the population for the study would be hard to locate. While random selection would give you a wide variety of participants, peoples' general memory and musical taste can widely differ, resulting in a population that would be hard to control for. The population would likely become more stable if one were to limit the demographic to similarly aged participants. They would need to be old enough to have strong associations with music from their lives, but young enough that no real deterioration has begun in their brain. The study also holds the possibility of using two populations, one which is younger and studied to see if the researchers can determine zones in the brain that are specifically correlated to musical facets. The other would then be the older population who the researchers would be able to test ideas about recall on as the population is more likely to have developed stronger correlations as they have aged.

A way around the population problem would be to run a series of case studies. Case studies would allow for more in-depth research to be conducted on each participant, but would not be able to get the same correlational results that would be possible from a large population. The case study participants would be able to provide specific musical examples that they have strong associations with, which can result in the possibility of finding important musical facets by examining the music, instead of the brain, to look for similarities in the music that each

person found to have strong recall. If these same musical facets present throughout several of the case study participants, researchers would then have an idea of what elements to focus on in future research.

Study 3: What difficulties can be studied while working with aged memories?

Working with aged memories can be difficult, as the brain tends to alter or forget memories as we age. This means that the memory that is being recalled in a clinical session or researcher's study might not be the true memory.

A study on forgetfulness and aging found that the most common reason we forget a memory is because we are not exposed to something associated with the memory, or we do not use the information pertained in the memory enough (Yokota et. al, 2000). This could present a challenge to researchers if they are using music that is of the appropriate time period for the participants, but they have not heard it recently enough to keep the memories tied to the music.

Another possibility of something to be researched is how the elderly respond to auditory tasks. The elderly are said not to be able to respond as well to musical memories because they have lost strength in their auditory cortex, the strength is even lower when the task involves short-term recall (Davis et. al, 2003). This poses an issue for researchers trying to research musical memories, as they would not be able to stimulate the participants. A possibility for overcoming this would be to either use music videos, or videos of performers. The thought here being while the participant cannot hear the music, the visual stimulation might be strongly enough paired with the missing auditory to allow the participant's memory to be recalled.

If this study were to take place the research team would need to be able to control for the fact that several important memories from the participant's life would likely be gone. This research is meant to be done on people in late life and the chances of all important memories being retained is low. Because of this, the researcher may find better success using participants in case studies. This is because the participants can be selected who fit the basic criteria necessary for the study. From there the researchers will need to adapt their methods and measures to each individual participant and would again have specific details, but not generalizable results. This approach would be best if there was a certain population that the researcher wanted to study, such as veterans or musicians.

An alternative to the case study approach would be to study groups that regularly interact with each other such people who attend a community group for third-agers or a group from the same nursing home. While these participants would not have the same total life experience, they would likely have shared experience gained from years spent together that could then be tested for recall. This method would be beneficial, especially the nursing home, as health information about the participants could be available, and the researchers would know about any major differences between the participants before conducting research. The shared experiences of the participants would also act as a sort of control for the researchers, allowing them to have baseline details of the events being recalled, as well as how the recalled events differ for each person being studied.

## Summary

The brain is a complex organ that adapts and changes as we age. All brains start to become impaired as they age, but the level and rate at which this happens varies between people. Sometimes there is a small decay in the brain such as Age Related Cognitive Decline; other times the decay is more severe and ends in Dementia or Alzheimer's.

While there are several aspects of memory processing we do not know, we know the general path memories follow while being stored in the long-term memory. We also know that autobiographical and episodic memories are two types of memories that exist and that these memories often have strong associations with their stimulus, a common stimulus being music.

Music has an impact on the brain of the elderly, regardless of previous musical training the aged brain responds to music, allowing the brain to be more active. Music is also stored in the brain through a process that differs from other stimuli, such as verbal. This allows for musical stimulation to activate memories and brain functions that other stimuli are not able to activate.

Music is also an emotional stimulus, meaning that different musics can induce emotions in their listeners. Whether that emotion is happy (nostalgic), sad (evoked sadness) or traumatic depends on the specific music and if the listener has an association previously formed with the music. The same music might be able to recall an autobiographical memory for the listener, transporting them to the mindset they were in when hearing the music.

Music also differs between the classical and popular genres, with both sides having different aspects that allow the listener to create memories. Popular and classical music are also not mutually exclusive, popular music can use traditionally classical music, and classical music

can take idioms and texts from popular music. The cross-over of style could act as a stronger stimulus for memories. The music therapist would then be able to understand all of this and apply the techniques and theories that they are trained in to advance the life of their clients.

Research about the brain and how it is stimulated by music is growing, however there needs to be more done about it. Through the research presented in this paper, as well as the supposed studies, this research can be further conducted. Based on this research a working music therapist would be able to understand how their client's brain works, as well as how to be a more effective therapist to their client, allowing for greater work to take place in the field.

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