Forget-Me-Notes

by Kevin DiFazio

The mind is a beautiful and awesome place. At any given moment there is a symphony of electrical impulses and chemical particles swirling around inside of every person in the world, unseen. The impulses shoot through the brain cells to the optic nerves, which in turn move the eye. The eye receives the information of what you are reading on this page, sends it back into the thalamus and into the visual cortex on the frontal lobe, where the information is interpreted and you are finally able to understand what you are reading; all of this in the span of less than a second. So why, when our brains possess this seemingly infinite computing capability and unbelievable potential, can it fail so catastrophically? Why can our brains function perfectly one day and on the next, we aren't able to recognize the faces of our children or our parents?

Our cognitive faculties can leave us for a number of reasons, from brain damage in an accident to Alzheimer's and dementia. Memory loss, an unfortunate side effect of many of these situations, can leave patients lost and confused. For instance, patients who suffer from dementia, an unfortunate condition that is often associated with memory loss, usually start developing symptoms by the time they are 65 years old and sometimes earlier (“What is Dementia”). However, there is a treatment that, when administered preemptively, can reduce the potential effects of memory loss: learning to play an instrument.

Clive Wearing, a British musicologist, suffers from anterograde and retrograde amnesia. (“Life Without Memory: The Case of Clive Wearing, Part 1”). He cannot remember the past and he cannot learn anything into the future. When pressed, Clive can only actively remember three things: his name, that he has been asleep for a long time, and that he loves his wife Deborah. Clive contracted viral herpes encephalitis in 1985, and as a result, suffered severe damage to his hippocampus, the center for most memories in the body. But Clive can do one very important and special thing. When asked, he has no recollection of being a musician—he staunchly

denies it. However, when placed in front of a piano, despite having no conscious ability to read music or perform, Clive can play—well enough that you would not know he was suffering at all. But how is this possible with such damage to the hippocampus?

In order to understand Clive's unusual case, and subsequently understand how playing an instrument can stave off memory loss, we must first understand how memories are stored and retrieved in the body. In humans, as was previously stated, memories are stored in the hippocampus, a part of the limbic system which also contains the amygdala. The amygdala is the center for emotions in your brain and cooperates with the hippocampus to store and process memories. While Alzheimer's shrinks the brain and very severely shrinks the hippocampus, it leaves the amygdala relatively intact ("Alzheimer's Changes the Brain"). Given the intertwined functioning purposes of the amygdala and the hippocampus, even when the latter is not working, triggering the former will result in the recall of deep-seated and emotional memories.

Hoping to further understand the connection between memory and emotion, Mohamad El Haj, Luciano Fasotti, and Philippe Allain chose to test the ability of patients with moderate cases of Alzheimer's in recalling memories in silence and then with music of their choice. After the periods of silence and played music, the patients had two minutes to recall a memory to their best ability. They were asked how emotionally moving each particular memory was, as well as their mood after having remembered it. The memory was rated on how specific it was, as well as the time that it took to remember it. Without the music, patients tended to recall a very generic moment attached to a place and time (241-242). The emotional connection to the memory was relatively low, as were the patients' moods after having remembered it. On average, it took patients 30 seconds to recall the memory, a full nine seconds more than controls the same age without the condition. With music playing, patients tended to recall specific memories attached to a time and a place, without very many details. The emotional connection was much higher than when the test was done without music, and patients felt content after having remembered it. On average, it took patients about 26 seconds to recall the

memory, less than six seconds more than their control group of the same age without Alzheimer's. Music played a significant role in the recall of the memories of these patients. Those who have learned to play a musical instrument tend to be more exposed to and immersed in music (242). As any person who has listened to a particularly moving piece can attest to, music is able to reach us on an emotional level, and it is something musicians expose themselves to daily.

However, memory is not purely an emotional process. The act of memorizing something is a four-part process. The first part involves unconsciously becoming aware of a stimulus. This is often referred to as sensory or working memory. The second part involves becoming fully aware of the stimulus and then beginning to process that information. This is known as short-term memory and encoding. Then the mind finds a location to store the memory for future retrieval and use, a process known as storage. Lastly, the mind allows access to that information, and you are able to consciously articulate a memory. This process is relatively complicated, and the human brain performs it hundreds upon thousands of times a day. So, the question still remains: how and why would learning to play an instrument slow the degradation of this process?

There are two separate but equally important answers to this question. The first is actually a process that all humans go through while learning any skill, referred to as "muscle memory." "Muscle memory" is a common phrase used to describe what psychologists more commonly refer to as procedural memory. Saul Mcleod, a psychology professor at Wigan and Leigh College, defines procedural memory in his article "Long Term Memory" as "a part of the long-term memory that is responsible for knowing how to do things, memory of motor skills. It does not involve conscious thought." Procedural memory develops by continuous repetition of a complex task over an extended period of time (McLeod). Procedural memory is perceived and retrieved from the cerebellum, the center for movement and coordination in the brain. The cerebellum is completely separate from the limbic system and as a result is not affected by most causes of memory loss. This means that it is unnecessary to think about the performance of fine motor skills, such as walking, after a period of time because the brain is already unconsciously aware of how to execute those

actions. Clive Wearing contracted his condition at the age of 47. This was well into his musical career, and he was already widely regarded as a music expert at the time.

This explains how some musicians are able to retain their skills despite memory loss. But the question still remains: Why would playing an instrument slow down memory loss? A group of scientists in France performed an experiment in which musicians were compared to non-musicians on their familiarity with music. Sixty common instrumental melodies were played for the participants, and they were asked to rate them on a scale of familiarity while they were in an MRI machine. While the songs played, the MRI scanned their brain, to see where areas of activation occurred (Groussard et al. 1). The scans found that musicians had significantly more grey matter density in their front-left hippocampus and, based on scans of brain activity, their brains recalled more contextual details, linking their episodic memory to their subjective experiences (5). These scientists believe that "musical training may be associated with the development of specific memory abilities that could contribute to a greater cognitive reserve, which could reduce age-related decline in memory" (5). Musicians' brains are physically different as a result of their training, in such a way that it could slow and reduce the loss of memory.

But what causes the physical change in the structure of the brain? Simply put, it is a functional necessity. Grey matter is linked to muscle control and sensory perception and, as was previously stated, memory ("Brain Atlas"). Given that there are far fewer musicians that work alone than those who work in groups, most musicians need to be able to play with other people. They need the ability to listen to the music that they are creating, as well as that of every other person playing with them, in order to form a more perfect performance. Musicians need to have the ability to take in more stimuli in a moment than normal, and in response, their brains seem to develop accordingly.

Elyse George and Donna Coch tested the idea of working memory—the unconscious ability to register stimuli—of both musicians and non-musicians. Tests were

administered in which the subjects were asked to identify hidden stimuli that stuck out from a normal scenario, both in auditory and visual manners, repeat a sequence of digits or letters in the reverse order they were given, and repeat the locations that the administrators said given objects were supposedly located (George and Coch 1083-1084). The test found that, across the board, musicians were able to take in more stimuli and commit it to memory than non-musicians (1086-1090). It was also noted that on the auditory tests, musicians' brains elicited a much stronger response more quickly than non-musicians brains did to signify the unconscious observation of the hidden stimulus.

Despite all of the advantages learning to play an instrument seems to bestow on people, sometimes it is not enough. Many people still succumb to dementia and Alzheimer's and many other forms of memory loss. However, even in these cases, music seems to be something that is retained by the brain long after many functions have gone. Mentioned studies suggest that music aids in the retrieval of personal memories in dementia patients. Music itself also appears to be a memory that many dementia patients hold onto. It has been found in two separate studies that patients suffering from Alzheimer's are capable of recognizing familiar tunes even after many other memories have faded. One of the studies even found that patients only suffering from mild Alzheimer's were capable of recognizing familiar tunes 97.4% of the time, a score on par with the respective control group. Patients were even able to recall the melodies for some popular songs when only prompted by the lyrics (Vanstone and Cuddy 118-122).

Music is a powerful teaching tool as well as one that is biologically relevant. The body adapts to music to help ensure longevity of memory. As Groussardet et al. have found, the hippocampus becomes larger and builds up more neurons and grey matter in a person who has been constantly exposed to music. This means that the cells in the hippocampus can work more quickly and create a faster memory retrieval process. This is shown in music therapy, which is widely used to aid in speech pathology and assists patients who have forgotten how to speak. You receive chills when music plays or you play music because your body is releasing endorphins, a sign from your brain that it likes what it is being exposed to and

wants to continue to be exposed to it. Our bodies crave music and it seems that the world at large has no interest in preserving that need.

Simply listening to music isn't the key to helping our memory—and ourselves—be the best it can be. Nearly everyone has in some way listened to music, on the radio in their car or as background noise at work. But, like anything worth doing, music will only be able to help you if you put work into it to make it worthwhile. All of the studies done on musicians have been on ones who have been playing for long periods of time. They have been honing their skills and as a result their brains have changed for the better. Do you want to help yourself? Pick an instrument you have always wanted to learn. Start from the beginning. Take lessons. Teach yourself. Watch a YouTube video on how to read music. Practice for five minutes every day. Learning to play music isn't that hard and doesn't take that much time. It's been shown that your memory will improve from the experience. Who knows? It just might save your life.

Works Cited

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Kevin Di Fazio is a freshman psychology major with a minor in criminal justice. When Kevin graduates from James Madison University, he would like to work as a forensic psychologist. Kevin chose to combine his passions for psychology and music in writing this piece. He hopes that this piece will help shed light on one of the many reasons music is important to learn.

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