

# Music and memory: A qualitative look at how music affects episodic memory

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MUSIC AND MEMORY: A QUALITATIVE LOOK AT HOW MUSIC  
AFFECTS EPISODIC MEMORY

by

JONATHAN A. COAD

A thesis submitted in partial fulfillment of the requirements  
for the Honors in the Major Program in Psychology  
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## Abstract

This study was designed to examine qualitative data regarding gender and age differences about significant life events that are recalled when music is remembered. Two groups of participants were recruited, younger adults ( $M = 19.78$ ,  $SD = 4.99$ ) and older adults ( $M = 49.31$ ,  $SD = 8.72$ ). Data were collected by creating a survey and allowing participants to choose whichever songs, from their own experience, they like and asking them to list detailed memories that are attached to the song. Using the Linguistic Inquiry Word Count (2015) software, data was coded into categories of word count, positive and negative emotions, and how sociable words are. On average, young adults ( $M = 18.66$ ,  $SD = 13.39$ ) use more words when recalling their musical memories than older adults ( $M = 15.09$ ,  $SD = 8.86$ ). Data also suggests that young women ( $M = 9.76$ ,  $SD = 4.91$ ) use less words that are ranked as social than older women ( $M = 13.44$ ,  $SD = 6.25$ ). The impact of this study sheds some light on how music influences the memories of our culture, our society, and our self.

## **Acknowledgements**

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## **Introduction**

Music can influence the way in which we store our memories. While research has been conducted on music and its effect on the mind, it is still a relatively new field. It is believed that the perceptual memory system of the brain encodes auditory input into music (Jäncke, 2008). With the help of a functional MRI, some studies have shown that it is possible to map where musically inclined memories are formed in the brain. For instance, (Alluri et al., 2012) found that there is a large scale of brain networks in use when the mind is introduced to timbre, key, and rhythm. Using the fMRI, they were able to map specific areas of the brain that were highlighted when participants listened to music. This is relevant because we may be able to learn where specific memories are encoded based on the type of memory that is associated to music. For example, if a song brings about great sadness or elation, we may be able to see which parts of the brain are affected. Studies suggest that sounds are encoded much like smells when memories are attached, and are encoded through a multimodal neural system that supplies the feelings of familiarity (Plailly, Tillmann, & Royet, 2007). This study presented participants with random, familiar and unfamiliar smells, and familiar and unfamiliar musical excerpts. With the help of an fMRI, the researchers were able to map parts of the brain that recognize familiar sounds the same way that those parts of the brain recognize familiar smells. The location of this finding was in the left hemisphere and was connected to regions associated with semantic processing and memory (Plailly et al., 2007). This finding could imply that people who predominantly use the left hemisphere of their brain would be more likely to have a better memory if they relate their memories to smells and/or sounds.

Dr. Petr Janata (2007) states that “while an individual might not be able to recall the title of a song that was played at an event, that song might bring back memories and emotions of love, sadness, or social awkwardness.” He conducted an acclaimed study where participants rated levels of familiarity and salience. The participants were presented with stimuli in the form of excerpts of music. The excerpts were from the billboard’s top-100 list around the time that the participant would have been between 7-19 years old. Dr. Janata used the Linguistic Inquiry Word Count software, an analysis program, to divide the data into categories. His findings were that generally, people rate music as pleasant (Janata, Tomic, & Rakowski, 2007). These findings corroborated an earlier study by Schulkind (1999) who asked participants to rate how “happy” songs make them feel. In 2010, a follow-up study was performed where levels of nostalgia were tested. Participants again listened to excerpts of music and followed up with questionnaires. One finding was that the level of music related nostalgia is dependent on several existing constructs within the participant. That is, nostalgia was directly related to positive and negative emotions as well as personality traits. (Barrett, F. S. et al., 2010).

## **The Impact of Music**

### **Memory and Learning**

In the early seventies, Tulving first introduced episodic memory as a distinct event or personal experience. He went on to compare episodic and semantic memory and referred to both memory types as separate systems that interpret and encode information (Tulving, 1972). We use the encoded information to allow our experiences to permeate as memories. Beckerman & Gray (2014) talk about how music helps those experiences become memories, and later how music can help to recall those memories with just a few notes. Music has existed as a way to communicate feelings to others or to express emotion. With rehearsal, generations have passed down legacies and stories to their descendants. It has been used to preserve and carry on traditions in communities (Rubin, 1997). Like before, music is currently used as a powerful mnemonic tool to remember useful and nonsensical data (Schulkind, Hennis, & Rubin, 1999). Their study took participants from two age groups with a mean of ages 19 and 66. Participants were tasked with listening to excerpts of music and trying to recall the title of the song, the artist, and the year of production. Participants were also tested on preference ratings and emotionality towards the song. Significant age differences for familiarity were found and older adults were less probable to remember multiple attributes of a song (Schulkind, Hennis, & Rubin, 1999). Wallace (1994) had participants try to memorize text. They listened to text with either a repeated melody present or a different melody. She found that the melody of the song facilitates learning and that text is better recalled when heard as a song, than as text alone (Wallace, 1994). In example, this idea can be seen today within conventional religions, school house rock, and in nursery rhymes.

## **Health and Aging**

Research is being conducted to show how music can have a significant impact on all ages and in any stage of life. In 2015, a study was conducted on soon to be freshmen of high school where one group received continued musical training and the other did not. The group that received the training had consistent productivity throughout the remainder of their school years (Tierney, Krizman, & Kraus, 2015). Music also can have an ability to help influence the mindset of an individual. Shamans have used music to help heal the spirit, the body, and the mind (Mannes, 2011). Aside from spiritual medicine, music seems to have scientific uses as well. Särkämö, et al. (2008) conducted a study on 55 participants between 2004 and 2006 that had suffered from a stroke. They found that “regular, self-directed music listening, during the early stages directly after a stroke, can enhance cognitive recovery and help regulate mood” (Särkämö, 2008). It has also been found that music may help preserve the long-term memory for patients suffering from Alzheimer’s disease (Cuddy & Vanstone, 2015). The ideas that musical training or even just active listening could enhance our livelihood are exciting.

## **Culture**

Krumhansl & Zupnick state that “music helps to shape autobiographical memories, preferences, and emotional responses; and these memories are associated with strong emotions and nostalgic feelings.” In their study (2013) they showed that advertisers may want to focus on music that was popular twenty years prior to the age of the target audience of which they are selling. For example, in the year 2016, someone who is around the age of 40 should be targeted with music from 1996. The reason for this is attributed to a phenomenon called *cascading reminiscence bumps*, otherwise defined as autobiographical memories, preferences, and

emotional responses that are transferred from generation to generation. In their study, participants rated music preference from songs during and before their lifetime. The findings showed an expected rise of favorable responses as the musical pieces were closer to the participant's age (around 20). However, the findings also showed an unexpected peak of favorable responses towards music at the point where their parents would have been at age 20. Because parents listen to music from their young adult lives, kids grow up listening to the same tunes and remember them fondly. Examples of this are Beatles songs from any era. Their music has a lasting impact on memories, and they experience continued success today, even with new generations. At a certain age, music is more influential, usually between the ages of 10 and 30 (Krumhansl & Zupnick, 2013).

In his book, The Sonic Boom, Joel Beckerman discusses how sounds work together with our senses to help experiences become realities. He discusses how music is used to influence our decisions, such as where to shop or what to eat. Music is used in all forms of advertising and its use in capturing our imagination is almost an art form in and of itself. Musicians perform to express emotion, to promote ideals, or to impart wisdom. It is up to the user to decide how to interpret the input of their emotions.

### **Music and Emotion**

It is believed that “emotional feelings serve as retrieval cues for memories that are associated with that emotion” (Bower, 1981). Music not only has the ability to make us swoon with emotion, but the musical piece itself can be rated as having either positive or negative qualities. Eschrich, Munte, & Altenmüller (2008) organized a study where participants listened to 40 songs. After a week, they returned to listen to 80 songs, 40 previously heard, and 40

randomly interspersed. The task was to rate which pieces indicated arousal or valence. “Musical pieces that were rated as very positive were remembered significantly better” (Eschrich, Munte, & Altenmüller, 2008). In a follow-up study, Altenmüller et al., (2014) used an fMRI to effectively show specific networks of the brain that were necessary for the retrieval of memories and for the processing of emotions. This study also indicated that valence is an important modulator for memory and is recognized quickly. Evidence suggests that positive music is remembered better, but how would that affect how individuals categorize their own memories? Using a broad survey of self-reports, Simon & Nath, (2004) found that young adults with lower income report frequent feelings that are more negative than those of older, more well off individuals. This study also found that there are interesting gender differences in the frequency of emotions reported; women report more feelings of anxiety and of sadness than men report, and men report more feelings of calmness and of excitement than women report (Simon & Nath, 2004).

When thinking about self-reports, it is important to think about an individual’s mind frame. For instance, do the words that we are using reflect how we truly feel? Dr James Pennebaker would argue that yes, the words that you use say more about you than you may realize. He says “However, our most striking discovery was not about the content of people's writing but the style. In particular, we found that the use of pronouns - I, me, we, she, and they - mattered enormously. The more people changed from using first-person singular pronouns (I, me, my) to using other pronouns (we, you, she, they) from one piece of writing to the next, the better their health became. Their word use reflected their psychological state” (Pennebaker, 2011). He continues on and brings up an interesting point about how pronouns are function

words. He argues that they require social skills to be used properly (Pennebaker, 2011). Our study aims to analyze the use of social words by adults when recalling episodic memories about music they have listened to over their lifetime.

### **Linguistic Inquiry Word Count (LIWC)**

The aforementioned social psychologist, James Pennebaker worked closely with Martha Francis to create the Linguistic Inquiry Word Count software. LIWC (2015) is the fourth generation of this program (Pennebaker et. al, 2015). This version has been rebuilt from the ground up and includes ‘netspeak,’ such as lol or thx, now common in twitter and facebook responses. The LIWC program is made up of two parts. The first part, the central processor, is the meat and potatoes of the software. The processor allows users to upload bodies of text and then analyzes the text in its entirety. The second part of the program is its dictionaries. “Each word in a given text file is compared with the dictionary file” (Pennebaker, 2011). Once the text has been analyzed, it is compared against internal dictionaries comprised of words which have been granted scientific value. That is, the words have been tested over time, and consistently show to have the same weight. Upwards of 90 categories have been included within the program, which allow the user to divide the data into cohesive sections. For instance, the program has the ability to break up the data into categories which define, but are not limited to, perception, social processes, and emotional tone.

Kahn et al, (2007) issued a study where he challenged the validity of the software. He had participants write essays describing days in their lifetime including one of three variables; amusement, sadness, and another day of usual activity. Results suggest that the LIWC software was accurate in its descriptions of emotions, with higher reports of positive words in the amusing

essay, and higher reports of negative words in the essay that reflected sadness. The categories that were chosen for our study are: word count, word length, social processes, and word emotionality (positive v. negative). “Social words make reference to other people (e.g. they, she, us, talk, friends). Usually, people who use a high number of social words are more outgoing and more socially connected with others. The more that people use positive emotion words (e.g. happy, love, good), the more optimistic they tend to be. If you feel good about yourself, you are more likely to see the world in a positive way. Use of negative emotion words (e.g. sad, kill, afraid) is weakly linked to people’s ratings of anxiety. People who associate themselves as always being unlucky tend to have a poor outlook on life” (LIWC, 2006).

## **Research Questions**

The aim of this study was to follow up Dr. Janata's research (2007; 2010) while exploring new ideas about age and gender differences. Although he has pioneered the study of participants' musical memories when listening to music, our study did not allow participants to listen to music. Instead, they recalled from their own episodic memory whichever song they would like to talk about and then rated their feelings accordingly.

One hypothesis relates to word count. Young adults should use more words when recalling their episodic memories than older adults. This could occur because as we age, memories decay. Data have shown that people retain detailed knowledge about their favorite songs over the course of their lifetimes (Schulkind, Hennis, & Rubin, 1999). That said, the older adults have had twice as many memories as the young adult group and may have more concise memories in relation to music.

A second hypothesis follows the research conducted by Simon (2004). It is predicted that women will be more likely to report memories of social words more than men. This is believed because as a culture, we may be primed from early development to seek different approaches of coping. Men tend to isolate themselves, whereas women tend to look for social events to process emotion. Another hypothesis is that personality may predicate the type of music that individuals prefer to listen. By using scales of musical preference and a personality type survey, we can look at how individuals relate to music and their personality types.

## Method

### Participants

Two groups of participants were recruited for this study. The first group was recruited via the psychology department at the University of Central Florida, which allows undergraduates to participate in research studies in exchange for extra credit. Four hundred fifty students participated. However, after data quality control, only 351 students remained. Some questions were inserted as a quality check and were not answered correctly and other surveys were incomplete. Participants were 53% female and ranged from 18-54 years old ( $M = 19.78$ ,  $SD = 4.99$ ). To obtain the second group of participants, students were allowed to earn extra credit if they asked their parent(s) and/or legal guardian(s) to participate in the study. Initially, 120 parents participated, but due to the same data quality management mentioned above, 40 parents were excluded. There were 80 parents who were 69% female with ages ranging between 38-77 years of age ( $M = 49.31$ ,  $SD = 8.72$ ).

### Procedure

An online Qualtrics survey was administered through SONA at the University of Central Florida. Participants were asked to think of songs that reflect memories. Essentially, they were asked to recall 5 specific songs that represent a time in their lives where they remember either positive or negative emotions. This allowed each participant to provide their own favorite, or least favorite memories attached to songs based on their life events. They were given an example of “When my grandmother hears the song ‘Don’t sit under the apple tree with anyone but me,’ she recalls memories of her late husband and thinks about when he returned from WWII. These memories

make her feel happy.” This example was included in the instructions to clear up any confusion about the task at hand. They were then told that they should be able to identify songs from their past and list specific memories that are triggered whenever the song is currently played. Each successive song would be different from the previous song(s) mentioned. If anyone was unable to think of different songs, then he or she was allowed to use one of his or her previous selections, but were asked to use different descriptors when describing how the song makes them feel. This was done that so that data was not intentionally replicated. When participants decided which song they would like, they were asked to include the title, artist, genre and the approximate age at which they had first heard the song. Then, they were asked to list three words that best described the emotions that they felt whenever they heard the song. Next, participants were asked to respond to the following questions: Why is this song significant to you? Does this song make you think of anyone on particular? Who? When you hear this song, does it impact your mood? How? Are there any activities or places that this song is emotionally tied to? What do you like or dislike most about this song? Once they had completed the qualitative survey, some individual differences surveys were presented, some basic demographics, and they were thanked for participating. Upon completion, they had the opportunity to have their parent(s) or legal guardian complete a separate yet identical survey for additional credit.

### **Data Analysis**

The LIWC (2015) program was utilized to ensure that there would be an accurate description of the emotional tone of each response. As previously mentioned, the data were analyzed in the categories of word count, social words, word length, positive words, and negative words. Manipulation checks were used throughout the survey to determine whether the

participant was paying attention. Questions such as “answer true for this question” or “please mark highly accurate for this response” helped weed out participants who did not take the study seriously. Some surveys were left incomplete, or were filled out with nonsensical data. These responses were also not included in the study.

### **Coding**

A qualitative study offers rich data for analysis and allows participants to fill in the blanks with their own words. However, this presents challenges for researchers because of the inability to easily translate responses into numerical data. Fortunately, the LIWC program would translate the data so that it would reflect a response that is more easily coded. The program looks at the response of the individual as a whole and breaks down percentages for whichever classification it is identifying. One example is if you present a sentence, 10 words in length, and 3 words are positive, then the results will show that the statement was 33% positive. Each word holds equal value. That is, the word elated is not scored as being more positive than the word happy.

### **Individual Differences**

As part of a larger study, several scales were included for participants to complete. Each of these scales will be included in the appendices of this paper. However for the current study, two scales are of importance. The first scale is the Short Test of Musical Preferences (STOMP) introduced by Rentfrow & Gosling (2003). It allowed participants to rate their musical preferences and then provided a scale for different measures of personality. The full description of the scale can be found in Appendix A. Of equal importance, was the Mini-IPIP Big Five

personality scale, introduced by Donnellan et al., 2006. This scale measures typical, potential behaviors and asks that they be answered in an honest manner about how the participants see themselves currently. By choosing how accurate or inaccurate the statement is, it provides invaluable information. Upon completion of the scales, a demographic questionnaire was administered asking questions about gender, age, race, education, and level of musical training.

## Results

For this study, we chose to analyze one of the questions that were asked to the participants. Specifically, does this song make you think of anyone in particular and whom. The answers were drawn from all 5 songs and compiled into comparable data. A one-way ANOVA indicated that between gender and word count  $F(1,427) = 1.23, p = .268$ , where males ( $M = 17.68, SD = 12.75$ ) and females ( $M = 18.25, SD = 12.75$ ) showed no significant difference. Figure 1 displays an independent-samples t-test that was performed showing that the word count analysis yielded a main effect for different age groups,  $F(1,427) = 6.19, p = 0.13$ . In this case, young adults ( $M = 18.66, SD = 13.39$ ) used more words when recalling their memories about songs, than older adults ( $M = 15.09, SD = 8.86$ ),  $t(172) = 2.92, p = .004$ .

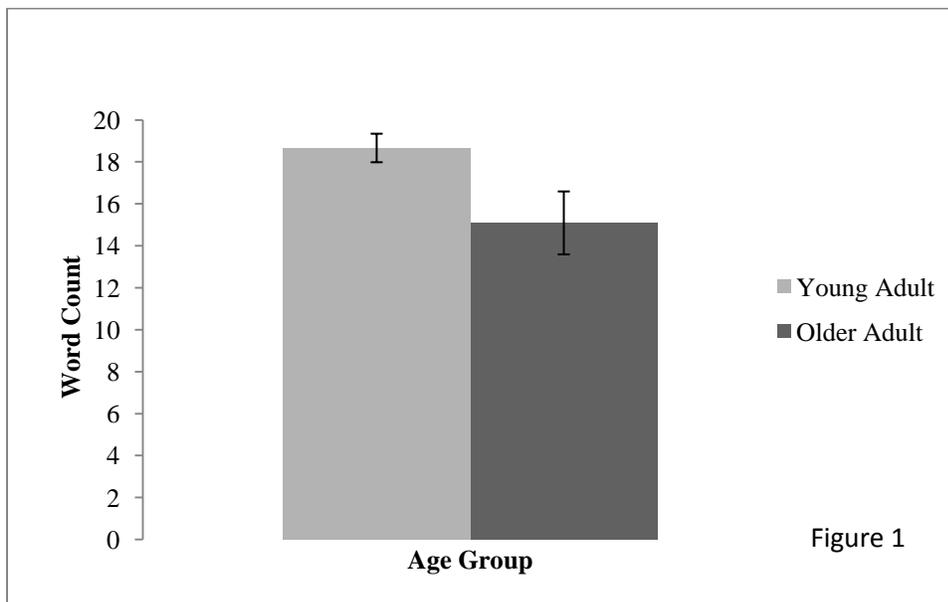
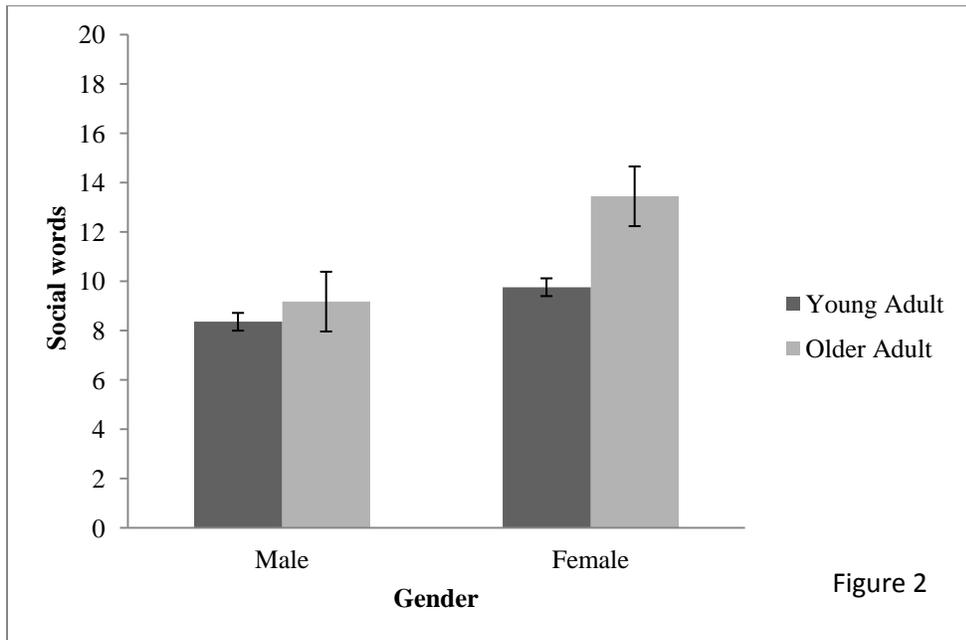


Figure 1: Graph showing the main effect for age groups and word count

ANOVAs were conducted on age group and gender for word emotionality as well. There was no significant difference between young adults ( $M = 5.80, SD = 4.73$ ) and older adults ( $M = 5.57, SD = 4.14; F(1, 427) = .229, p = .633$ ) for positive words. Women ( $M = 5.49, SD = 4.04$ ) and men ( $M = 6.12, SD = 5.30; F(1, 427) = 2.59, p = .611$ ) also showed no significance. As for negative words, young adults ( $M = 1.07, SD = 1.68$ ) did not differ significantly from older adults ( $M = 0.79, SD = 2.50; F(1, 427) = 1.71, p = .192$ ). Gender also did not yield significant results when the use of negative words was compared between males ( $M = 0.91, SD = 1.61$ ) and females ( $M = 1.08, SD = 1.92; F(1,427) = 0.87, p = .345$ ).

A 2(gender: male or female) x 2(age group: young or older adults) ANOVA was conducted on the amount of social words used when recalling memories related to music. The analysis yielded a main effect for the grouping variable  $F(1,427) = 11.06, p = .001$ . In this case, older adults ( $M = 11.31, SD = 6.46$ ) used a higher percentage of social words than younger adults ( $M = 9.06, SD = 4.92$ ). Similarly, there was a main effect for gender  $F(1, 427) = 17.45, p < .001$ . Post hoc-t-tests showed that for males, older adults ( $M = 9.17, SD = 6.04$ ) and younger adults ( $M = 8.35, SD = 4.85$ ) did not differ significantly,  $t(187) = .76, p = .45$ . However for females, older adults ( $M = 13.44, SD = 6.25$ ) used more social words than younger adults ( $M = 9.76, SD = 4.91$ ),  $t(240) = 4.58, p < .001$ . Results can be seen in figure 2.



**Figure 2: Graph showing an interaction between gender, age, and social words**

A univariate ANOVA was conducted on word length in comparison to age groups. The results indicated that young adults ( $M = 15.83, SD = 6.00$ ) did not differ significantly from older adults ( $M = 15.10, SD = 6.46; F(1, 427) = 0.96, p = .327$ ). In addition to age, gender was also compared and findings imply that men ( $M = 14.25, SD = 6.61$ ) responded in a similar fashion to women ( $M = 14.02, SD = 5.67; F(1, 427) = 0.57, p = .449$ ).

We also ran a bivariate correlation analyses on musical preferences and personality type. Table 1 shows a list of results from that analysis. It can be seen that those who scored high in the extraversion category like upbeat and conventional music, but relate more to energetic and rhythmic music. The opposite is true for those who are agreeable and conscientious, such that they scored higher in upbeat and conventional music than energetic and rhythmic music. Participants who rated high as being open to new experiences tend to like reflective and complex

music along with music that is intense and rebellious. Neuroticism did not score with any music preference type from the scale.

**Table 1: Musical preferences scored by personality types**

	RC	IR	UC	ER
Extraversion	-.069	-.040	<b>.153<sup>**</sup></b>	<b>.214<sup>†</sup></b>
Agreeableness	-.078	-.024	<b>.201<sup>†</sup></b>	<b>.131<sup>*</sup></b>
Conscientiousness	.018	-.038	<b>.217<sup>†</sup></b>	<b>.107<sup>*</sup></b>
Neuroticism	-.087	-.003	.073	-.068
Openness	<b>.261<sup>†</sup></b>	<b>.315<sup>†</sup></b>	-.046	.095

*Note.* \* p <.05      \*\* p <.01      † p <.001

RC = Reflective/Complex

IR = Intense/Rebellious

UC = Upbeat/Conventional

ER = Energetic/Rhythmic

## Discussion

The way in which we communicate can say just as much about us as the words that we use. Pronoun use alone could indicate a person's level of health (Pennebaker, 2011) or their level of wealth (Simon & Nath, 2004). In this study, we found that age affects the amount of words that people use when they recall their memories about music. This could likely coincide with the findings of Simon & Nath (2004). They found a significant age and educational difference in emotional expressiveness, such that younger and more educated participants expressed more emotions than older or less educated peers. There could be several explanations for why this exists. The younger age group of participants in this study was comprised of college students who are used to expressing themselves clearly and at length. Contrarily, the older group could likely be more used to telling their story. Because the older group is more concise, they do not need as many words to get their point across. It is also possible that with time, memories fade, lending more credence to the younger groups increased word count. The reason we did not find a difference in positive or negative response types based on age is likely because both groups are positive about their circumstances (Simon & Nath, 2004). While previous research suggests that older groups are more likely to say positive things, it is probable that college students see themselves as successful, and therefore say things which reflect that mind-frame.

When discussing our findings about social words, several possible reasons for the results come to mind. For starters, the older population of women outscored the younger population of women. One important thing to remember is that the older population is comprised of the younger population's parents. That said, they have had experience referring to more than just themselves. It is likely that the parental group is far more used to saying "we" and "us," than a

young adult who is possibly self-absorbed. It could also be argued that the older group ( $M = 49.31$ ), grew up in the sixties and seventies; a time that could be considered to have a more social outlook on life. Some may claim that music brought people together more so in that era than today. A famous example of this illustration is the famous musical gathering, Woodstock.

Gender differences also bring up some interesting questions about the response type of musical memories. Research tells us that women use more words of anxiety and sadness than men, and report being more responsive as well (Simon & Nath, 2004). This could explain why in our study, women reported more social words than men. Perhaps women are more socially inclined and are used to seeking the company of others to authenticate their feelings. Men on the other hand, may be more used to dealing with issues on their own and prefer isolation.

Other questions which come to mind include whether genres can be more social than others, or if our technology is driving a wedge between traditional social activities. The tradition of coming together and singing as a group seems to be a dying fad. Religious services and concerts still employ these tactics, but the introduction of the internet has made it convenient to participate online instead of in person. Also, the introduction of headphones has made it more difficult to interact socially and has encouraged isolation. Because of these “innovations,” the younger generation has grown up thinking that it is normal to be secluded, whereas an older generation may be more used to sharing a collective idea as a culture. In fact, when in public it can be perceived as rude if one is playing music without headphones. It is also possible that the sheer number of available artist and songs today make it difficult to have universal experiences

with music. This would have been less so before the invention of satellite radio and MTV.

Perhaps music is generational and our memories of music change with the times.

Our findings reflect that extraverts enjoy energetic and rhythmic music the most. While this may have been expected, it does help validate the idea that people who are extraverted can be more outgoing and energetic. Other research suggests that extraverts like the *shared* interest in popular music—connecting them to other people—rather than the stimulation provided by the rhythm or volume of the music (Pearson & Dollinger, (2004). It also makes sense that those who relate to being more agreeable or conscientious would relate to conventional music. Interestingly, those who are open to experience scored highest in rebellious and reflective music. Maybe their ability to try new things allows them to find pleasure in different types of music than a conventional or outgoing listener. These findings corroborate with Dollinger (1993) and Rawlings & Ciancarelli (1997) who help to confirm the idea that openness to experience has a positive reaction to a variety of types of music, especially that, which is less mainstream.

### **Future Research**

In future studies, it may be intriguing to introduce a third age group of participants. What I am suggesting is that grandparents be recruited as well. We may find that they have very explicit memories that belong solely to them, or musical memories might be attached to important dates that people shared collectively, such as a flashbulb memory. It is possible that with such a small sample size of available music or available outlets to receive that music that we see a trend in the type of music that is remembered. Of course it is also possible that those memories have faded even more so than the older adult group of this study making it harder for

them to remember. However, I hypothesize that the eldest group would have cherished those memories and held on to them in great detail.

Looking back, I may have limited myself by not rephrasing the questions that are asked of participants. The reason I mention this is because there were a number of responses that just said no. While this is a valid response and music does not have to make someone think of others, it seemed to be a lazy response that was chosen to get out of answering the question. Perhaps if the participant were guided to answer the question, such as “think of someone who you relate to this song,” or “when I hear this song it makes me think of..” Then again, if someone is not motivated enough to respond then we may not be able to encourage them. I’ll leave that for another study.

## **Appendix A: Short Test of Musical Preferences Scale**

Short Test of Music Preferences – STOMP (Rentfrow, & Gosling, 2003)

This is a 14-item scale that assesses musical preferences

**Mellow** – electronica/dance, new age, world

**Unpretentious** – pop, country, religious

**Sophisticated** – blues, jazz, bluegrass, folk, classical, gospel, opera

**Intense** – rock, punk, alternative, heavy metal

**Contemporary** – rap, soul/r&b, funk reggae

Participants will be asked to rate on a scale of 1-7 how much they like or dislike each genre. The ratings will then be scored using four music preference dimensions. They are Reflective & Complex, Intense & Rebellious, Upbeat & Conventional and Energetic & Rhythmic.

## **Appendix B: Satisfaction with Life Scale**

Satisfaction with Life scale (Diener, Emmons, Larson, & Griffin, 1985)

Below are five statements that you may agree or disagree with. Using the 1-7 scale (1 = strongly disagree, 7 = strongly agree) below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding.

In most ways my life is close to ideal

The conditions of my life are excellent

I am satisfied with my life

So far, I have gotten the important things I want in life

If I could live my life over, I would change almost nothing

## **Appendix C: Basic Empathy Scale**

Basic Empathy scale (Jolliffe, & Farrington, 2006).

How strongly do you agree or disagree with the following statements? (1 = strongly agree to 5 = strongly disagree)

My friend's emotions don't affect me much. (r)

After being with a friend who is sad about something, I usually feel sad.

I can understand my friend's happiness when she/he does well at something.

I get frightened when I watch characters in a good scary movie.

I get caught up in other people's feelings easily.

I find it hard to know when my friends are frightened. (r)

I don't become sad when I see other people crying. (r)

Other people's feelings don't bother me at all. (r)

When someone is feeling 'down' I can usually understand how they feel.

I can usually work out when my friends are scared.

I often become sad when watching sad things on TV or in films.

I can often understand how people are feeling even before they tell me.

Seeing a person who has been angered has no effect on my feelings. (r)

I can usually work out when people are cheerful.

I tend to feel scared when I am with friends who are afraid.

I can usually realize quickly when a friend is angry.

I often get swept up in my friend's feelings.

My friend's unhappiness doesn't make me feel anything. (r)

I am not usually aware of my friend's feelings. (r)

I have trouble figuring out when my friends are happy. (r)

## **Appendix D: Mini-IPIP Big Five Scale**

The Mini IPIP Big-Five Scale (Donnellan, Oswald, Baird, & Lucas, 2006).

Here are phrases describing people's behaviors. Please use the rating scale below to describe how accurately each statement describes you. Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. So that you can describe yourself in an honest manner, your responses will be kept in absolute confidence. Please read each statement carefully, and then fill in the bubble that corresponds to the number on the scale.

Each question will be answered ranging from very inaccurate to very accurate.

Am the life of the party

Sympathize with others' feelings

Get chores done right away

Have frequent mood swings

Have a vivid imagination don't talk a lot

Am not interested in other people's problems

Often forget to put things back in their proper place

Am relaxed most of the time

Am not interested in abstract ideas

Talk to a lot of different people at parties

Please select moderately accurate for this statement.

Feel others' emotions

Like order

Get upset easily

Have difficulty understanding abstract ideas

Keep in the background

Am not really interested in others

Make a mess of things

Seldom feel blue

Do not have a good imagination

## **Appendix E: Social Desirability Scale**

Social Desirability scale (Crowne & David, 1960).

Listed below are a number of statements concerning personal attitudes and traits. Read each item and decide whether the statement is true or false as it pertains to your personality.

Before voting I thoroughly investigate the qualifications of all the candidates.

I never hesitate to go out of my way to help someone in trouble.

It is sometimes hard for me to go on with my work if I am not encouraged.

I have never intensely disliked anyone.

On occasion I have had doubts about my ability to succeed in life.

I sometimes feel resentful when I don't get my way.

I am always careful about my manner of dress.

My table manners at home are as good as when I eat out in a restaurant.

If I could get into a movie without paying and be sure I was not seen I would probably do it.

On a few occasions, I have given up doing something because I thought too little of my ability.

I like to gossip sometimes.

There have been times when I felt like rebelling against people in authority even though I knew they were right.

No matter who I'm talking to, I'm always a good listener.

I can remember "playing sick" to get out of something.

Select false for this statement.

There have been occasions when I took advantage of someone.

I'm always willing to admit it when I make a mistake.

I always try to practice what I preach.

I don't find it particularly difficult to get along with loud mouthed, obnoxious people.

I sometimes try to get even rather than forgive and forget.

When I don't know something I don't at all mind admitting int.

I am always courteous, even to people who are disagreeable.

At times I have really insisted on having things my own way.

There have been occasions when I felt like smashing things.

I would never think of letting someone else be punished for my wrong-doings.

I never resent being asked to return a favor.

I have never been irked when people expressed ideas very different from my own.

I never make a long trip without checking the safety of my car.

There have been times when I was quite jealous of the good fortune of others.

I have almost never felt the urge to tell someone off.

I am sometimes irritated by people who ask favors of me.

I have never felt that I was punished without cause.

I sometimes think when people have a misfortune they only got what they deserved.

I have never deliberately said something that hurt someone's feelings.

## **Appendix F: IRB Outcome Letters**



University of Central Florida Institutional Review Board  
Office of Research & Commercialization  
12201 Research Parkway, Suite 501  
Orlando, Florida 32826-3246  
Telephone: 407-823-2901 or 407-882-2276  
[www.research.ucf.edu/compliance/irb.html](http://www.research.ucf.edu/compliance/irb.html)

## Approval of Exempt Human Research

From: **UCF Institutional Review Board  
#1 FWA00000351, IRB00001138**

To: **Valerie K. Sims and Co-PI: Jonathan Coad**

Date: **September 25, 2015**

Dear Researcher:

On 09/25/2015, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review: Exempt Determination  
Project Title: Music and Memory  
Investigator: Valerie K Sims  
IRB Number: SBE-15-11615  
Funding Agency:  
Grant Title:  
Research ID: N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the [Investigator Manual](#). On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

A handwritten signature in black ink that reads "Joanne Muratori".

Signature applied by Joanne Muratori on 09/25/2015 11:53:29 AM EDT

IRB Manager



University of Central Florida Institutional Review Board  
Office of Research & Commercialization  
12201 Research Parkway, Suite 501  
Orlando, Florida 32826-3246  
Telephone: 407-823-2901 or 407-882-2276  
[www.research.ucf.edu/compliance/irb.html](http://www.research.ucf.edu/compliance/irb.html)

## Approval of Exempt Human Research

From: **UCF Institutional Review Board  
#1 FWA00000351, IRB00001138**

To: **Valerie K. Sims and Co-PI: Jonathan Coad**

Date: **October 22, 2015**

Dear Researcher:

On 10/22/2015, the IRB approved the following minor modification to human participant research that is exempt from regulation:

Type of Review: Exempt Determination  
Modification Type: An additional 300 study participants will be recruited for a new total of 900 study participants.  
Project Title: Music and Memory  
Investigator: Valerie K Sims  
IRB Number: SBE-15-11615  
Funding Agency:  
Grant Title:  
Research ID: N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the [Investigator Manual](#). On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

A handwritten signature in black ink that reads "Joanne Muratori".

Signature applied by Joanne Muratori on 10/22/2015 08:07:31 AM EDT

IRB Manager

## **Demographics Survey**

Q1 How old are you?

Q2 What is your gender?

Male

Female

Q3 What is your race?

White

Hispanic or Latino

Black or African American

Native American or American Indian

Asian/Pacific Islander

Other

Q4 What is your highest completed grade level?

High School/ GRE

Freshman

Sophomore

Junior

Senior

Technical School

Master's

Ph. D.

Q5 What is your level of musical expertise (Select all that apply)

I don't like music

I like to listen to music

I used to play an instrument in school

I play an instrument for recreation

I play an instrument in a group or professionally

Q6 In what zip code did you grow up?

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