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Unforgettable: The Relationship between Music and MemorySamantha Beedy¹

For generations, college students have claimed that listening to music helps them to study better. But does research support this idea? Past research on the subject has yielded mixed results. Some studies suggest that music helps enhance cognitive performance, some find no difference, and some studies find that music hinders cognitive performance. The present study explored the relationship between soft background music and working memory. Participants were given lists of words to memorize and recall on a blank sheet of paper. Each participant completed two memorization and recall trials, one with music and one without. Participant's recall performance was compared. In addition, participants' recall performance in the presence of music with lyrics and music without lyrics was compared. The results of the study indicated that there was no significant difference between the presence of soft background music and no background music. In addition, there was no significant difference between music with lyrics and music without lyrics in the music condition.

For centuries, music has played a prominent role in the lives of human beings. We use it as a form of expression, a way to relax, and as a pathway for escape. But does music have the ability to improve our cognitive performance? Countless students of all ages have claimed that they can study better while they listen to their favorite music, but does research support this idea? Several researchers have sought to answer this question and have produced very mixed results. Some researchers claim that music of any kind (or even the presence of irrelevant speech or sounds) negatively impacts cognitive performance on basic working memory tasks. Other researchers have found little difference in performance. Interestingly, some researchers even argue for the benefits of background music to reading comprehension and other complex cognitive tasks.

Researchers have explored the relationship between music and memory in a variety of ways. One recent study by Alley and Greene (2008) attempted to directly explore the

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relationship between music and working memory. Past research in this area has suggested that participants' recall of visually presented digits was disrupted by the presence of irrelevant speech patterns. However, this effect varies with both the task and the level of auditory distraction. In regards to music specifically, research has shown that non-vocal music, such as classical music, was less disruptive to participants than speech. Other past studies which compared cognitive performance in the presence of vocal and non-vocal music revealed that those performing tasks to vocal music performed worse (Alley & Greene, 2008).

The present study explored working memory performance in college students under four different conditions: vocal music, non-vocal music, irrelevant speech, and silence. Sixty college students were recruited for this. Using a within-participants design, participants were shown several sequences of digits on a computer screen and were asked to recall them on paper immediately after (Alley & Greene, 2008). Participants wore headphones regardless of the auditory condition. In the music conditions, participants were presented with either a normal or a karaoke version of a popular pop song. In addition to this, participants were asked to rate their familiarity with each song and their level of distraction in each condition. Performance on the working memory tasks were best in the silent condition, followed by non-vocal music, then irrelevant speech, and lastly vocal music (Alley & Greene, 2008).

In a similar study, Chamarro-Premuzic, Swami, Terrado, and Furnham (2009) explored the influence of auditory background stimuli on creative and cognitive task performance in high school students. Seventy-seven high school students completed two cognitive tasks and one creative task. In similar fashion to Alley and Greene (2008), Chamarro-Premuzic et al. (2009) placed students under four different background noise conditions: radio speech, city noise, vocal music, and silence. In order to decrease familiarity in the music condition, students could have been presented with pop, R&B, hip hop, or alternative music. In addition, students were also

measured on their level of extraversion. Background auditory stimuli did not have any significant relationship with performance on either cognitive task. However, extraverted students were found to have performed better on the creative task while listening to music (Chamarro-Premuzic et al., 2009).

While many studies focus on both music and speech in relation to cognitive performance, some choose to focus exclusively on speech. One such study asserts that speech and sound stimuli prove to be detrimental to participants' performance on a variety of cognitive task. Sometimes referred to as the irrelevant speech effect, both the quality and the number of speech subjects play a role in task performance (Beaman, 2004). In one experiment, 37 undergraduate students were visually presented with 30 lists of 16 words, labelled as "to be recalled content." At the same time, students were presented with spoken lists of words that were labelled as "to be ignored content." After viewing each list, participants were asked to recall the visually presented words in any order on paper. Participants performed this serial recall task in the presence of either silence, spoken words unrelated to the visual lists, or spoken words related to the visual lists (Beaman, 2004). Surprisingly little difference was found between each condition, although a difference did exist. Participants recalled the most words correctly in the quiet condition, followed closely by the unrelated words condition and finally the related words condition. It had been suggested in previous studies that there could be some relationship between working memory recall and the ability to suppress or inhibit information in the face of distraction (Beaman, 2004).

A striking number of studies on music and its relation to cognitive performance take place within a school setting. This is unsurprising, as many students have claimed to be able to study better with the presence of music. Past research on a variety of cognitive tasks (including working memory recall) have been mixed, yielding unfavorable, neutral, or favorable results. A

study by Anderson and Fuller (2010) suggests that past studies have provided weak evidence for music as a detriment to performance. One such study attempted to test the impact of vocal and non-vocal music on both reading comprehension and short term memory tasks. A negative impact was found, but it was an insignificant one. Other past studies have claimed that reading comprehension and music comprehension are similar. If this is true, music can be used to enhance cognitive performance. To test this, one study used pleasant and unpleasant classical music in an attempt to relax participants as they performed a reading comprehension task (Anderson & Fuller, 2010).

The recent study by Anderson and Fuller (2010) explored the impact of lyrical music on reading comprehension in 334 junior high students. A baseline measure of reading comprehension was taken first. Afterwards, students took a reading comprehension test either in silence or in the presence of vocal top Billboard hits. Afterwards, students were surveyed on their study habits and musical preferences. Students were also asked to rate how much they liked the music presented in the music condition on a Likert-type scale (Anderson & Fuller, 2010). Using a within-subjects design, it was found that reading comprehension scores were lower in the music environment than reading comprehension scores in the silent environment (Anderson & Fuller, 2010). Interestingly, however, the benefit of music in a school setting is still debated. A recent neuroscience conference provided evidence that musical training had benefits to working memory by virtue of establishing a phonological loop for rehearsing verbal stimuli (Pearce & Christensen, 2012).

This present study, like its predecessors, is meant to explore the relationship between music and memory. In the context of this study, memory is simply defined as the ability to retain and recall information. Two different types of music were used: music with lyrics and music without lyrics. The music with lyrics used was a soft, vocal jazz song, while music without lyrics

was defined as classical music. Participants were asked to complete a small memorization task under one of three conditions: music with lyrics, music without lyrics, or silence. There were two major hypotheses. First, participants who were exposed to soft background music during the memorization period will be able to recall more information than participants who were not exposed to music. Second, participants who were exposed to music without lyrics will be able to recall more information than participants who were exposed to music with lyrics.

Method

Participants

A total of 25 participants were gathered for this study. Of these participants, 7 (28%) were male and 18 (72%) were female. All of the participants were students of Lindenwood University. In terms of class rank, 10 (40%) participants were freshman, 10 (40%) were sophomores, 1 (4%) were juniors, and 4 (16%) were seniors. None of the participants identified having had hearing problems that would have hindered their ability to hear music in this study. Participants were sampled via convenience sampling through the Lindenwood Participant Pool (LPP). Prior to the study, a sign-up sheet and a brief description of the study was pinned to the participant recruitment board outside of the LPP office. Participants were able to sign up for a specific date and time slot to participate in the study. The participants reported to Young 105, located on the bottom floor of the science building on campus, for their appointed time. Every participant was given one LPP credit, which can be used for bonus points in any of his or her participating classes, as compensation.

Materials

A small demographic survey was used to better describe the participants of this particular study (see Appendix A). Because this was a study on the relationship between background music and the ability to memorize and recall information, two songs were chosen. “Waltz of the

Flowers” (Piotr Illyich Tchaikovsky, 1892) was used for the music without lyrics condition. “Unforgettable” (Nat King Cole, 1951) was used for the music with lyrics condition. Both of these songs were chosen based on several criteria. Ideally, these songs were chosen to simulate music that might be played during a quiet study session. The songs had to be prominent enough in the participant’s awareness to not simply be tuned out. At the same time, these songs had to avoid being overtly distracting to the participant. For the memorization task, participants were asked to memorize two lists of 20 nouns. The first list, List A, described mammals and vegetables (See Appendix B.) The second list, List B, described birds and fruits (See Appendix C). The subjects in each list were chosen in order to make the lists similar to one another, but not so similar that the participant experiences interference at the time of recall.

There were several other materials used in this study. Participants were given a fresh piece of paper and a pencil for each recall period. A stopwatch was used to time participants during each memorization period. Each song was played through a playlist put together by the researcher on iTunes. The environment of the study was a small, quiet room allotted to the researcher by the Lindenwood Participant Pool. This room was relatively plain and free of distractions. The room was equipped with a simple table and chairs for the participant and the researcher.

Procedure

Upon their arrival to the research room, participants were asked to take a seat at a table and to carefully read over the informed consent form. Participants were asked to sign two copies of the informed consent form: one for the researcher and one for the participant to keep as a reference. Once completed, participants were then given the demographic survey to complete. Afterwards, participants were given one of the lists of nouns. Participants were instructed to memorize as many of the nouns as possible in the span of 1 min. If the trial called for it, the

music was turned on by the researcher. Music was played from an iTunes playlist on a laptop placed off to the side, where it would not be a distraction to the participant. Once the participant felt ready, the memorization period began.

After time was called, the list was taken away and placed out of the participant's sight. If music was playing during this trial, it was turned off. The participant was given a blank sheet of paper and a pencil and was instructed to write down as many words as he or she could remember. There was no time limit for this. The participant was also not required to list the words in any particular order. Misspellings were not penalized, although words that were not on the list but were written down on the participant's answer sheet were not counted. Once the participant had recalled as much as he or she could, the answer sheet was taken away and put aside by the researcher.

The participant was given a new list to memorize for the second memorization trial. If the trial called for it, the music was once again turned on by the researcher. Like the last trial, the participant was asked to memorize as many words as possible in the span of 1 min. Once time was called, the second list was taken away and placed out of the participant's sight. If music was playing during this trial, it was turned off at this time. The participant was given a fresh answer sheet and was asked to recall as many words from the second list as possible. Words recalled from the list from the previous trial were not counted. After the participant had recalled as many words as he or she could, the answer sheet was taken away. Participants were debriefed on the study and given an information letter. Participants were given their LPP credit and were dismissed.

During this study, counterbalancing was used in the presentation of both the music and the lists. Participants could have experienced one of four possible conditions. Some participants experienced no music in the first trial, while others experienced music first. Some participants

might have also been presented with List A first, while others may have been presented with List B first. Finally, some participants were exposed to music with lyrics, while others were exposed to music without lyrics. All participants experienced both a music trial and a no music trial, but the order of music presentation and the type of music presented varied from participant to participant.

Results

Statistical analysis for this study involved two different *t*-tests. To test the significance of the music and the no music condition, a paired related samples *t*-test was used. The mean number of words recalled correctly in the music condition was $M = 11.48$ with a standard deviation of $\sigma = 3.466$. In the no music condition, the number of words recalled correctly was $M = 11.84$ with a standard deviation of $\sigma = 2.427$. Results of the analysis found $t(24) = -.630, p = .534$. In order to test the significance of the music with lyrics and music without lyrics condition, an independent samples *t*-test was used. The mean number of words recalled correctly in the music with lyrics condition was $M = 11.86$ with a standard deviation of $\sigma = 4.258$. The number of words recalled correctly in the music without lyrics condition was $M = 11.00$ with a standard deviation of $\sigma = 2.191$. The results of this analysis found $t(23) = .606, p = .551$.

Discussion

The results of both statistical analyses found that there was no significant difference between the presence of soft background music and the presence of no music and all on working memory tasks. The mean number of words recalled in the no music condition was only very slightly higher than the mean number of words recalled in the music condition, which amounted to no significant difference. Likewise, there was no significance between the music with lyrics and the music without lyrics condition on working memory tasks. Surprisingly, the number of words recalled in the music with lyrics condition was slightly higher than the music without

lyrics condition, contrary to the original hypothesis. This difference was small, however, and showed no significance in the statistical analysis.

The methodology of this study posed some limitations. The research room allotted to the researcher by the Lindenwood Participant Pool was located in one large room in which four smaller research rooms were clustered together. Although the research room used was quiet most of the time, there were other times in which other research was being conducted just outside, creating a small noise distraction. In addition, students leaving their classes just outside could also be heard and could have created a distraction to the participant. In addition, the song used for the music without lyrics condition was determined to be almost too quiet to hear in certain places, especially at the beginning of the song. This was less than ideal, as it could have been either distracting to the participant or it could have been too easily tuned out. Finally, although the music used was meant to stimulate music that might be played during a quiet study session, it was later determined that this music was not what college students might typically play while studying. This study found no significant relationship between music and memory, but the results are still inconclusive. As it stands, there are still many studies out there that have found contradictory results. In college students, a future study might explore the relationship between listening to favorite music and ability to recall information on a test.

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Appendix A

Demographic Survey

Gender Male Female Other/ do not wish to say

Class Rank Freshman Sophomore Junior Senior Other

Are you aware of any hearing problems that may hinder your ability to hear music today?

Yes

No

Appendix B

List A

- 1. Porcupine**
- 2. Broccoli**
- 3. Carrot**
- 4. Giraffe**
- 5. Horse**
- 6. Tiger**
- 7. Cucumber**
- 8. Elephant**
- 9. Asparagus**
- 10. Spinach**
- 11. Olive**
- 12. Deer**
- 13. Cat**
- 14. Lettuce**
- 15. Whale**
- 16. Pepper**
- 17. Dog**
- 18. Peas**
- 19. Lion**
- 20. Zucchini**

Appendix C

List B

- 1. Parrot**
- 2. Canary**
- 3. Finch**
- 4. Apple**
- 5. Parakeet**
- 6. Banana**
- 7. Orange**
- 8. Tangerine**
- 9. Hummingbird**
- 10. Robin**
- 11. Grapes**
- 12. Blue Jay**
- 13. Grapefruit**
- 14. Pear**
- 15. Woodpecker**
- 16. Swan**
- 17. Duck**
- 18. Melon**
- 19. Heron**
- 20. Watermelon**