The Effects of Music on Memory for a Word List

Emily Konantz
Music and Memory

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Using 40 university students as participants, memory for a word list was tested using different conditions in which subjects had to listen to music or no music during study and test phases. Previous research has indicated that music can enhance mood and sports performance (Fassbender et al., 2012) and Mann (2008) found that sounds in an environment enhance learning. The context in which something is learned and encoded was found by Balch et al. (1992) to enhance memory if such conditions are repeated in the test phase. This led to the hypothesis that the condition in which no music was played during study or test would produce the best results. The results of the experiment did not reflect the hypothesis in that it only mattered if there was music playing during the study phase as it had a negative effect on encoding. Other reasons included small representation of the gross population and lack of control in the test environment as well as lack of reliability and validity.

Much research has been done on the effects of music and sounds on performance in many areas of study. However, there have been mixed results about what kind of effects music can have. Music has been associated with better memory and situations in which people learn something that are repeated in the test phase are better remembered. This can have implications in the real world because it can be helpful or it can hinder study habits. This is very useful for high school and university students. According to an article by Fassbender et al. (2012), music does have an effect on memory. This research found that music during a study or learning phase hindered memory at a test phase but increased mood and sports performance. Research by Mann (2008) indicates that sound in the environment, and not necessarily music, enhances learning.
Fassbender et al. (2012) presented a virtual history lesson to students under different environmental conditions. These conditions consisted of either background music, or no background music, along with either a 3 monitor display system or an immersive reality center. The results found that memory for the history lesson was better for the 3 monitor display system with no background music and for the immersive reality center with background music. The concept of context dependent memory is also a major factor in these studies because many studies have shown that it does matter that conditions in study and test are the same. It especially comes into play in a study by Balch et al. (1992). Context dependent memory is the notion that the something that is learned or studied in particular conditions will be remembered best if those particular conditions are repeated during the testing phase. McGeoch (1932) stated as part of his hypothesis that if the contexts are different during study and test, the subject is not only likely to not remember, but to actively forget some things that were studied and learned. As stated by Balch et al. (1992), context not only can depend on music and background noise or stimuli but on the certain smells, the time of day, alcohol or drug states, and the mood in which one is in at the time of encoding. In the experiment performed by Balch et al. (1992), results showed the highest number of words recalled was the group in which the same cue was played during the study phase and during the test phase not only displaying evidence of context dependency but that “this procedure revealed that context dependency was significant” (Balch et al., 1992). Context dependency is important and relevant to this type of research because if the context is important, people may hinder their own learning by listening to music while studying and not while taking the test or vice versa.
Wallace in 1994 tested subjects for their memory of words when they were sung as song lyrics rather than when they were spoken to them. She demonstrated that “the melody of a song can facilitate learning and recall” (Wallace, 1994). The context dependency effect comes into play here as well because the results of this experiment showed that subjects only remembered a significant amount more about the words when the same melody was used for all three verses of the song than when each verse had a different melody. In fact, when the melodies of the verses was different, the subjects actually remembered less, showing that if the context isn’t the same, it can actually hinder learning. Wallace also showed that the actual melody of the song contributes to learning of the words more than just the rhythm of the music. When text is sung, people chunk words and verses together and use other memory aids “to assist in learning, in retrieving, and if necessary, in reconstructing a text” (Wallace, 1994). There are many different suggestions as to how and why music helps with memory for text and Samson & Zatorre (1991) suggest that it may be because music employs different encoding mechanisms and stores music in a different place in the brain and therefore hearing the melody again can facilitate retrieval. Maybe adding melody to text makes it more unique in memory rather than it being like every other word in one’s mind. The music may make more connections in one’s brain and therefore makes it easier and faster to retrieve (Wallace, 1994).

Past research has overall found mixed results in whether music and background noise facilitates learning or hinders it, and whether or not context dependency effects matter and have a significant effect or not. The following report investigates these questions and my hypothesis is that the condition in which there is no music during
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study and no music during test will have the best results. This will occur because there will be identical contexts for study and test phases and there will be no music to distract subjects. The condition in which there is music during study and music during test will produce the next best results because this condition has context consistency. The condition that will do third best is the condition in which there is no music during study and music during test because there will be no distraction while the subject is encoding. Finally, the condition that will produce the worst results will be the condition in which there is music during study and no music during test because there will be distractions during encoding so the subject will not properly encode the information thus making it very difficult to recall (Figure 1).

Method

Participants

The participants used for this experiment were 40 university aged students all in attendance at the University of Western Ontario and affiliated Colleges. The participants consisted of both males and females and they were not assigned to groups evenly. Subjects were chosen haphazardly from friends, roommates, and classmates of the researcher and randomly assigned to a condition. Upon recruitment, participants were tested immediately in a silent room or area. The room was a typical classroom with minimal distractions. Prior to the present experiment, the subjects had been going about their day normally and were not expecting to be tested.
Figure 1. Summary of the hypothesis. This is the estimated result of the experiment indicating where the expected means are. The line on top represents the condition in which there was no music during the test phase and the line on the bottom represents the condition in which there was music during the test phase. The data points represent where the means of the different conditions are expected.
Materials

The materials used for this experiment were consistent across all participants. A consent form was given for the participants to sign which detailed the steps and the purpose of the experiment. Participants that had music as part of their experimental condition were given an Apple iPod Touch with Apple headphones to listen to Overture to the Marriage of Figaro by Mozart. This was given during all conditions in which music was involved and was consistent between all participants. Upon signing a consent form, participants were given a list of words for recall on a sheet of paper and then for their testing phase, they were given a second list of test words on a separate piece of paper. Participants were given a pen to record their answers. When finished, participants were given a debriefing form in case they had any questions. The experiment was conducted in quiet classrooms and living rooms where there was proper fluorescent lighting. The test was always given on a table where subjects had to sit on the chair in front of the table in order to participate.

Procedure:

Participants were recruited haphazardly and then placed randomly into one of the four conditions. They were then given a consent form to sign which detailed the purpose of the experiment and asked for their permission to participate. Upon signing, the researcher gave them brief verbal instructions on what to do. There were 4 groups of 10 subjects but each participant, although part of a group, participated individually. Each individual was haphazardly chosen from a group of university aged students and placed randomly into a group. The 4 groups were broken down as follows: group 1 was...
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music during study and music during test phases, group 2 was music during study and no music during test phases, group 3 was no music during study and music during test phases, and group 4 was no music during study and no music during test phases. There was a 30 second study phase in which subjects all studied the same list of 20 words which related to the common theme of clothing. During this 30 second study phase, participants in the music during study condition were listening to Overture to the Marriage of Figaro by Mozart playing on an iPod. Participants in the no music during study conditions studied the word list in silence for 30 seconds. During a 30 second break after studying, all participants were asked to think about what they had for breakfast. Following this 30 second break, participants were given 30 seconds for the test phase to recall as many words as they could from the list with or without music the same music, depending on their condition. Upon completion, participants were given a debriefing form and told they were finished.

Results

Figure 3 shows the ANOVA that was calculated to determine the interaction and the significance of each condition. The four conditions consisted of music during study and music during test (X₁), music during study and no music during test (X₂), no music during study and music during test (X₃), and no music during study and no music during test (X₄). The mean for X₁ was 16.1. For X₂ was 14.4, for X₃ was 15.5, and for X₄ was 16.5. Figure 3 represents the results for each of the conditions and the means of each of the conditions is displayed in Figure 2 represented by the two lines and the points. Because of the interaction, planned comparisons were carried out in order to find the differences between each of the means. It was discovered that there was a significant
Figure 2. Summary of the results. These lines represent what happened in the experiment. Each of the data points represents a mean of a particular condition. The difference between the music during study – no music during test data point and the no music during study – no music during test data point were the only conditions that were significantly different.
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**music/music**   **music/no music**

**no music/music**   **no music/no music**

**Planned Comparisons:**

- **music/no music** vs. **no music/no music**
  - $t = 2.57$ **Significant**

- **music/music** vs. **music/no music**
  - $t = 1.37$ **Not Significant**
  - Critical $t = 1.7$

- **no music/music** vs. **no music/no music**
  - $t = 1.22$ **Not Significant**

- **no music/music** vs. **music/music**
  - $t = 0.73$ **Not Significant**
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#### Figure 3

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The effect of interaction accounts for 13 percent of variance.

### Simple Main Effect

20.5

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**Figure 3.** Summary table of the results. This spreadsheet shows all the data collected from all participants in this study as well as all the means and calculations associated with the results. A planned comparison was done between all the means and found a significance between the music during study – no music during test condition and the no music during study – no music during test condition. This means that music hinders encoding during the study phase.
difference between the music during study and no music during test condition and the no music during study and no music during test condition. $t(38) = 2.57, p > 0.05$. The rest of the planned comparisons were not significant as shown in Figure 3.

Discussion

The hypothesis stated that the condition in which there is no music during study and no music during test will have the best results, followed by music during study and music during test, followed by no music during study and music during test, and lastly, music during study and no music during test. This meant that participants with no music during study and no music during test scores will be highest compared to all the other conditions. This hypothesis was based on past research by Fassbender et al. (2012) who stated that music actually hinders test performance for academics although it heightens mood and increases performance in sports. It was also based on research by Balch et al. (1992) which stated that test performance was best when taken in the same environment. The context dependency effect provided support for the hypothesis in the present experiment because it states that the context in which the material is studied must be the same at the test phase in order to obtain the best results (Balch et al., 1992).

The results of the present experiment indicate that the only variable which made a difference to the results significantly was the presence and absence of music in the encoding stage. Whether music was present or absent during recall made no difference to the results. Music during the study phase of the experiment may have been distracting to participants which would have affected their ability to properly encode the words. When it then came time for the test phase, it did not matter whether there was
music or no music, the subjects could not have remembered many words properly because they were not encoded properly at the study phase. If music was not present in the study phase, the environment surrounding the participant was quiet and therefore gave them what they needed to encode the words properly. When it came time to the test phase for these participants, the conditions were the same, further enabling better recognition and there was also no music to distract the participant. The planned comparisons of the other conditions were not significant. This may be due to a number of reasons such as sampling, environment in which the test was taken, lack of control, and measurement.

Participants were recruited haphazardly for the study among people in attendance at the University of Western Ontario and its affiliated Colleges. The participants were not a good representation of the gross population because they have many things in common such that they all chose the same school and they are all within 4 years in age of each other. This can have an effect on the results because of the way our brains develop at different times. Due to tuition payments and international fees, participants most likely have all come from somewhat affluent families and therefore some have most likely had similar opportunities such as travel. It can also have an effect because some people may be more accustomed to studying with music where others may not be. The environment in which the test was taken for each individual was not consistent. The test was given at inconsistent times of the day and therefore all participants were in different stages of their sleep-wake cycle. Participants were not expecting to be tested and therefore some of them had just come from class, some had just woken up, and
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some had just come from the gym, meaning some of the participants may have been in
different mindsets than others.

The test was scored out of a possible 20 marks in which the means for each
condition is listed on Figure 2. The test used to determine the results for this experiment
is not proven to be reliable or valid because there have been no tests like it in the past.
There is no indication of whether the test used for this experiment measures what it is
supposed to measure or if the results it produces are consistent. This is due to the fact
that many techniques for measuring memory were combined in an effort to incorporate
music. This may have skewed the results so that they did not reflect the hypothesis
because the test could be measuring something completely different than originally
planned.

The lack of control and the environment in which the test was taken were
potentially major factors in why the results do not reflect the hypothesis. The test was
given to participants in many different environments including the living room of their
home or in a quiet classroom. Although effort was made to ensure that the test areas
remained quiet and distractions minimal, test environments varied between participants.
Inconsistencies in test environments and lack of control by the researcher may have
skewed the results because one doesn’t know which condition the particular subject
belongs to and therefore one may have had an unfair advantage or disadvantage. It also
may have had an effect on the basis of the experiment that music was a distracter during
the encoding stage. If participants were not meant to have music but they were
distracted in other ways, this would show in the results as they would not have been able
to encode properly.
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To go further in this area of study, I would suggest testing the effects of music in other areas than just memory for words. It would be interesting to see how music during sports practice can have an effect during a performance and test phase. This can have important real world implications because it can teach people how to make their study and practise habits better and more specified to their particular and individual needs. If I was to conduct this specific study again, I would keep the test environments consistent through all participants thereby minimizing distractions and any distractions that come up will be consisted. I would also test many more subjects in order to broaden the sample and I would test a broader range of ages in order to see if there is a difference in ages. A broader sample would also include people from all levels of socioeconomic status and backgrounds to get a better representation of the gross population. In order to test more accurately, revisions to the test used may be necessary in order to get good reliability and validity. Revisions such as the content of the words and the number of words listed may need to be changed to make it harder, broader, or easier and to fit the particular test participants understanding and vocabulary. This study did not replicate previous similar studies in that it used a different test. This study also tested memory for a word list incorporating music which none of the previous studies did. Past research has generally tested memory for a lecture, sports performance, and music’s effect on people’s mood. This is a new test for this particular area of study which may have contributed to an unexpected result.
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References

